MILWAUKEE ROAD

BI-POLAR ELECTRICS

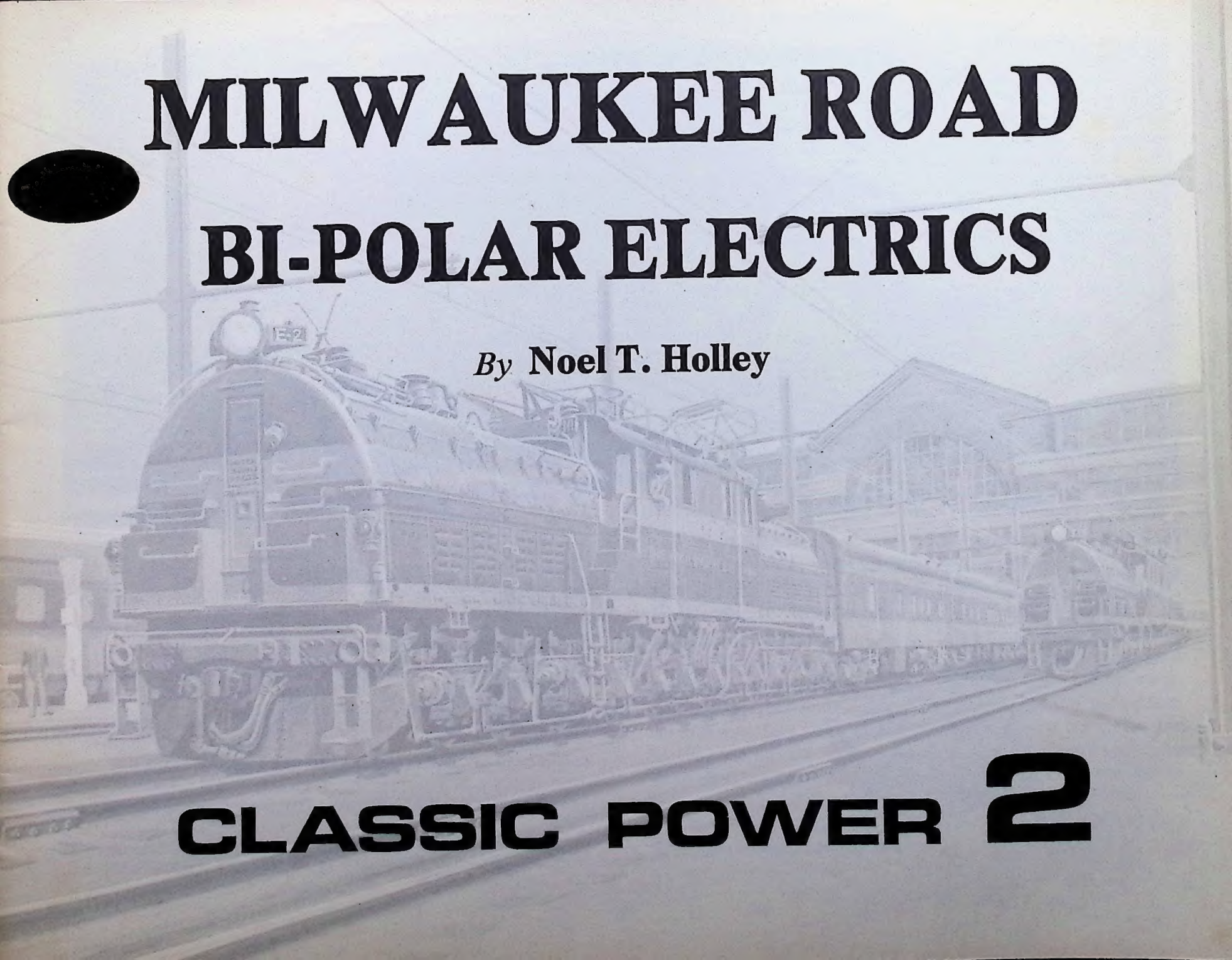
CLASSIC POWER 2

Railroad buffs will know that this is the bi-polar E-4. A few Milwaukee buffs might recognize the scene as the entrance to Tacoma, Washington, in 1949. A few car buffs may spot what appears to be a Nash, or 3? Chevy. / Photo from Albert Farrow collection.

MILWAUKEE ROAD

BI-POLAR ELECTRICS

By **Noel T. Holley**



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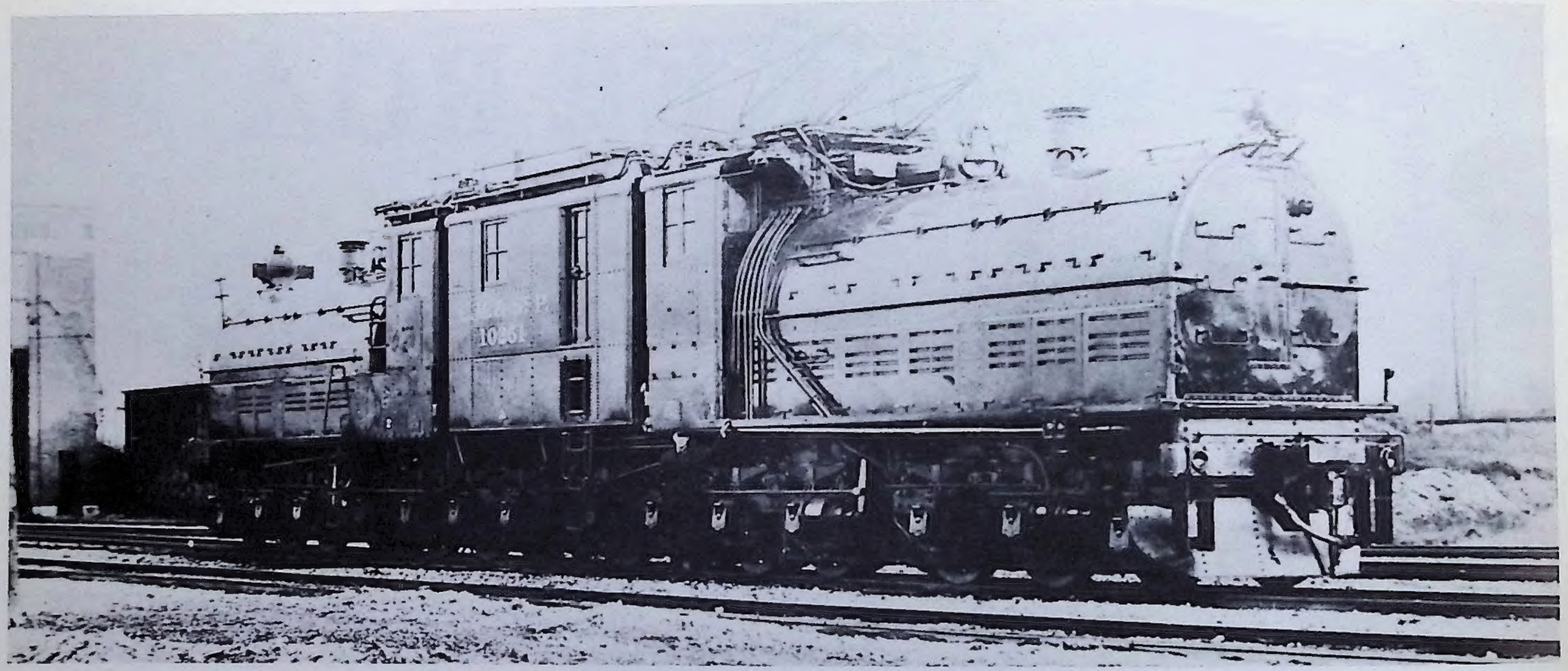

Fresh from the General Electric plant, the Milwaukee Road's bi-polar locomotive 10251(later renumbered E-2) as it appeared in 1920. Power unit no. 2 to the left, no. 1 to the right. The door in the center body was soon eliminated./G.E. photo from Custom Brass.

CHICAGO MILWAUKEE ST. PAUL AND PACIFIC

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Photo Credits as noted

Published for **N. J. INTERNATIONAL, INC.**

By LEEWARD PUBLICATIONS, INC., P.O. Box 149, Annapolis, Md. 21404

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The E-5 (ex-10254) at Deer Lodge, Montana, on 2 May 1957. The engine, streamlined in the mid-50s, is shown wearing the then standard three-color scheme of maroon, orange, and black. Note changes in configuration by relocated number board, air horn, and cleaning up of much hood detail./Photo from R.V. Nixon collection.

INTRODUCTION

There were only five Bi-Polars, but they were unique. They symbolized the Milwaukee Road and a train called "The Best to the East." They symbolized General Electric and the mainline electrification which lay just around the corner in our future. They symbolized a unique and facinating way to run a railroad, to thousands who saw them in the east and the west. In the east, they were remembered as an exhibit in the fair, but out west they were a part of everyday life. In houses by the tracks, people still recall their high pitched whistles and the ever-clanging bells which warned that a noiseless, smokeless train was coming their way.

Class EP-2, the Bi-Polar gearless electric was a Milwaukee Road showpiece...and it still is.

MILWAUKEE ROAD
BI-POLAR ELECTRICS

By Noel T. Holley

Hauling the Olympian, *the bi-polar 10253 passes near Kendall's Peak in the Cascade Mountains—one of the four ranges over which the Milwaukee Road operated.* /Photo by Milwaukee Road.

IN THE SHADOW OF KENDALL'S PEAK

A serene scene. The whispering wind in fir trees rising 200 feet at trackside. The tumbling rush of water in a distant creek lying hidden down a slope in the forest. Lush foliage so thick that it shrouds the looming Cascade mountains in green and hides the nearby deer that watch you.

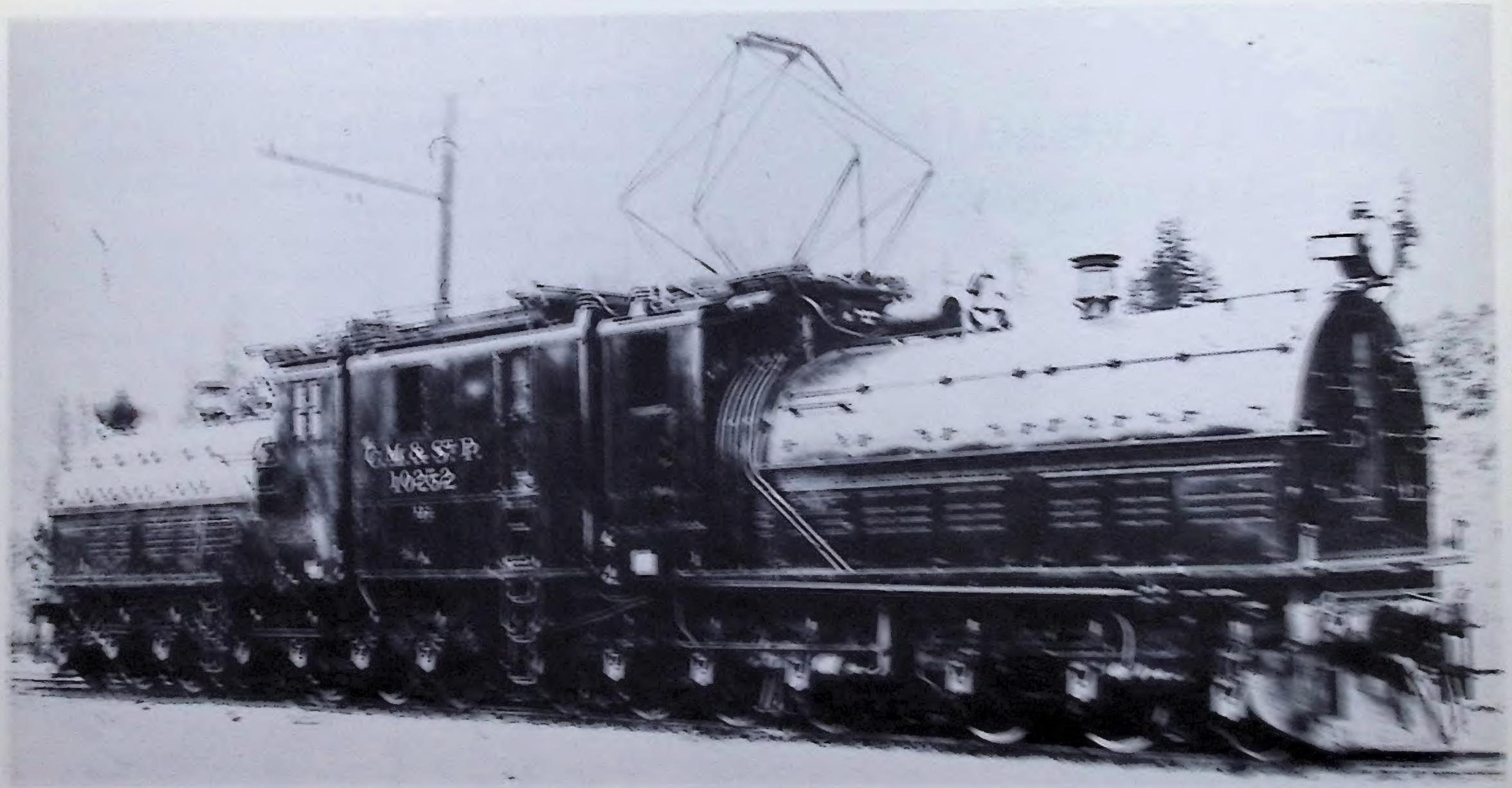
A bell. Or is it just some ringing in your ears as you wait, your camera ready for the Olympian coming upgrade headed east. You peer down the track and suddenly it's there. The huge, black, ten-two-fifty-three and a pumpkin-orange train of cars snaking around the curve and into view. No puffing, no jerking, no belching of smoke; just the clatter of wheels on rail and that omnipresent clang-clang-clang of the bell. You click the shutter and as you do, a shrill almost European high-pitched whistle lets you know that the engineer sends his regards.

This is mountain railroading, but it was almost as though that big EP-2 didn't have to fight against the mountain to tame it. It glided up a 1.7% grade with a thousand-ton train, and then disappeared in the trees, all in relative silence. It will be hitting close to 70 on the down grade after it rolls through Hyak at the summit. And all without disturbing a serene scene.

BI-POLAR BEGINNINGS
BIRTH OF A STEEL CENTIPEDE

In 1919, Woodrow Wilson was President, the war to end all wars had been over for a year, Prohibition was the law of the land and the United States Railroad Administration controlled the railroads.

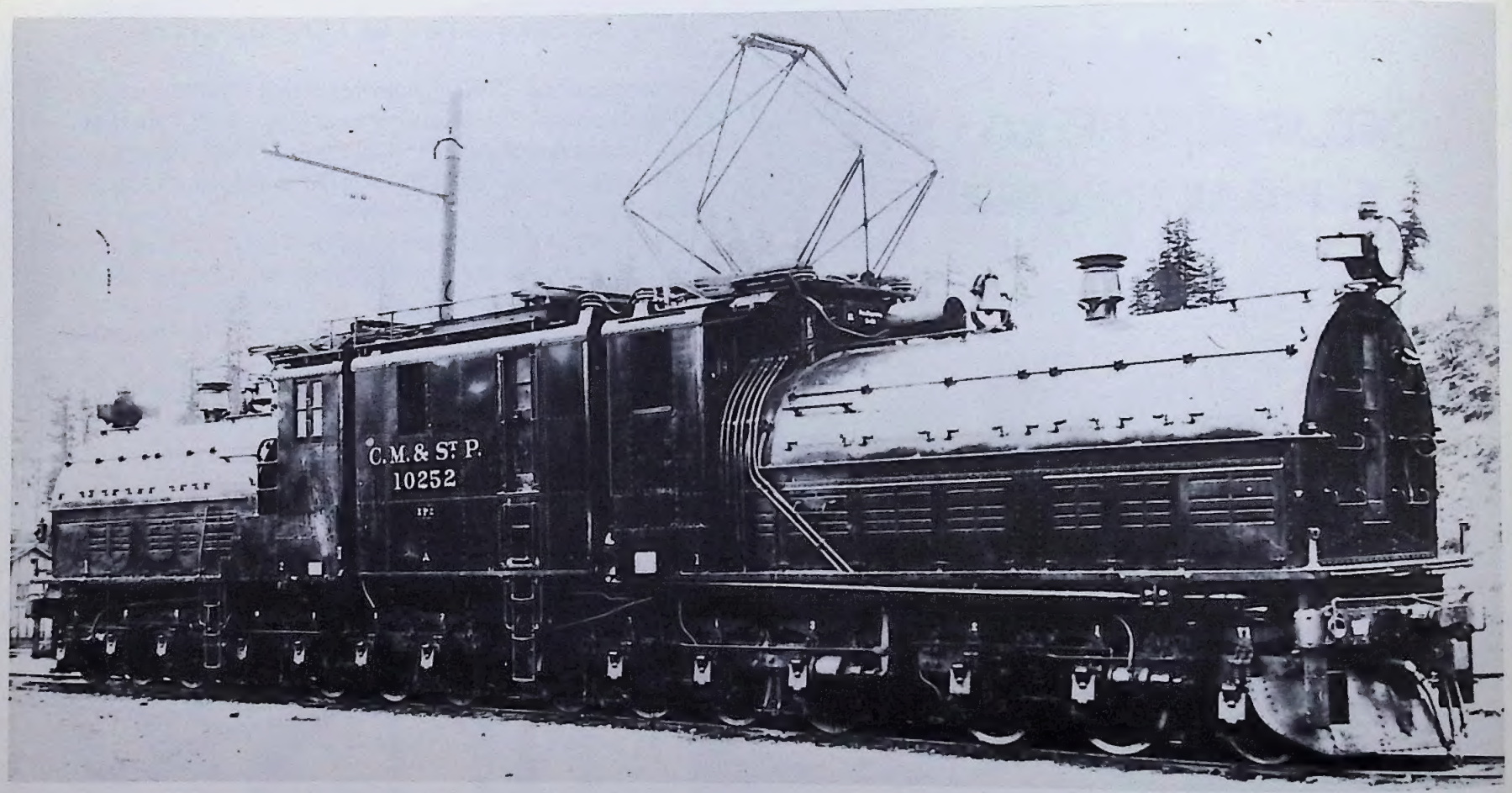
In 1919, also, the General Electric Company was busy completing a group of five electric locomotives that would eventually become some of the most famous locomotives that



The 10252 at Missoula, Montana, sometime in 1919. At that time the EP-2's were painted basic Black and still sported their side doors. Photo from Harold K. Vollrath collection.

G.E. ever built. They were 76 feet long, weighed 265 tons and ran on direct current at 3000 volts. They could produce 3,200 horsepower continuously and apply 123,500 pounds of tractive effort when they needed to start a train. They had 12 motors, rode on 28 wheels and at $200,000 each, they cost as much as several steam locomotives. Their road numbers were 10250 through 10254 and G.E. designated them the Bi-Polar Gearless Type. Their destination was the Coast Division of the Chicago, Milwaukee and St. Paul Railway.

These locomotives were called Bi-Polar because each traction motor had only two poles. These field poles were mounted directly on the locomotive chassis and surrounded each axle. They were gearless because instead of using high speed motors turning gears on the axles, they had low speed



The 10252 at Missoula, Montana, sometime in 1919. At that time the EP-2's were painted basic black and still sported their side doors./Photo from Harold K. Vollrath collection.

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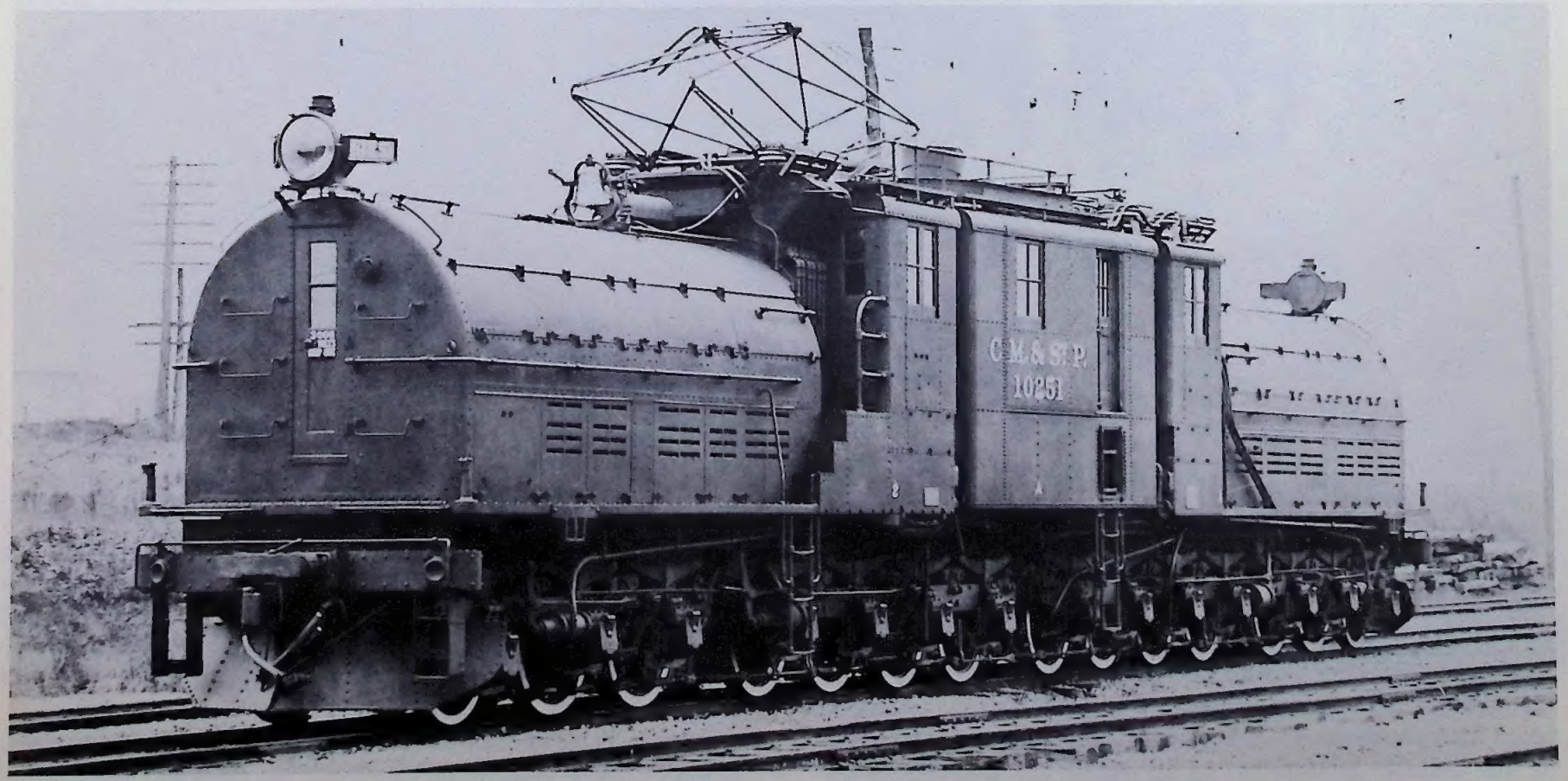
motors with the motor armatures mounted directly on the axles. These features made for a unique and silent locomotive. Since the motor speed was only 458 RPM at 60 miles per hour, there was no traction motor whine, and since there were no gears there was no gear tooth growl either.

Though these were not the first or only locomotives to use the bi-polar drive system, they represented a new height for railroad technology when built. They were briefly the "mightiest electric locomotives in the world," and their size and power attracted a lot of attention in the post war years of Model "Ts," flappers and noisy smoke-belching steam locomotives. The Bi-Polars had a distinct kind of beauty and this coupled with their other attributes made them good for public relations. General Electric hoped that these locomotives would signal the dawn of an electric age for mainline railroads in the United States. A time when all American railroads would

This photo of 10251, brand new from Erie, clearly shows the relatively uncluttered appearance, the EP-2's presented as compared to their later day complexion with all the various added appliances and modifications./ G.E. photo.



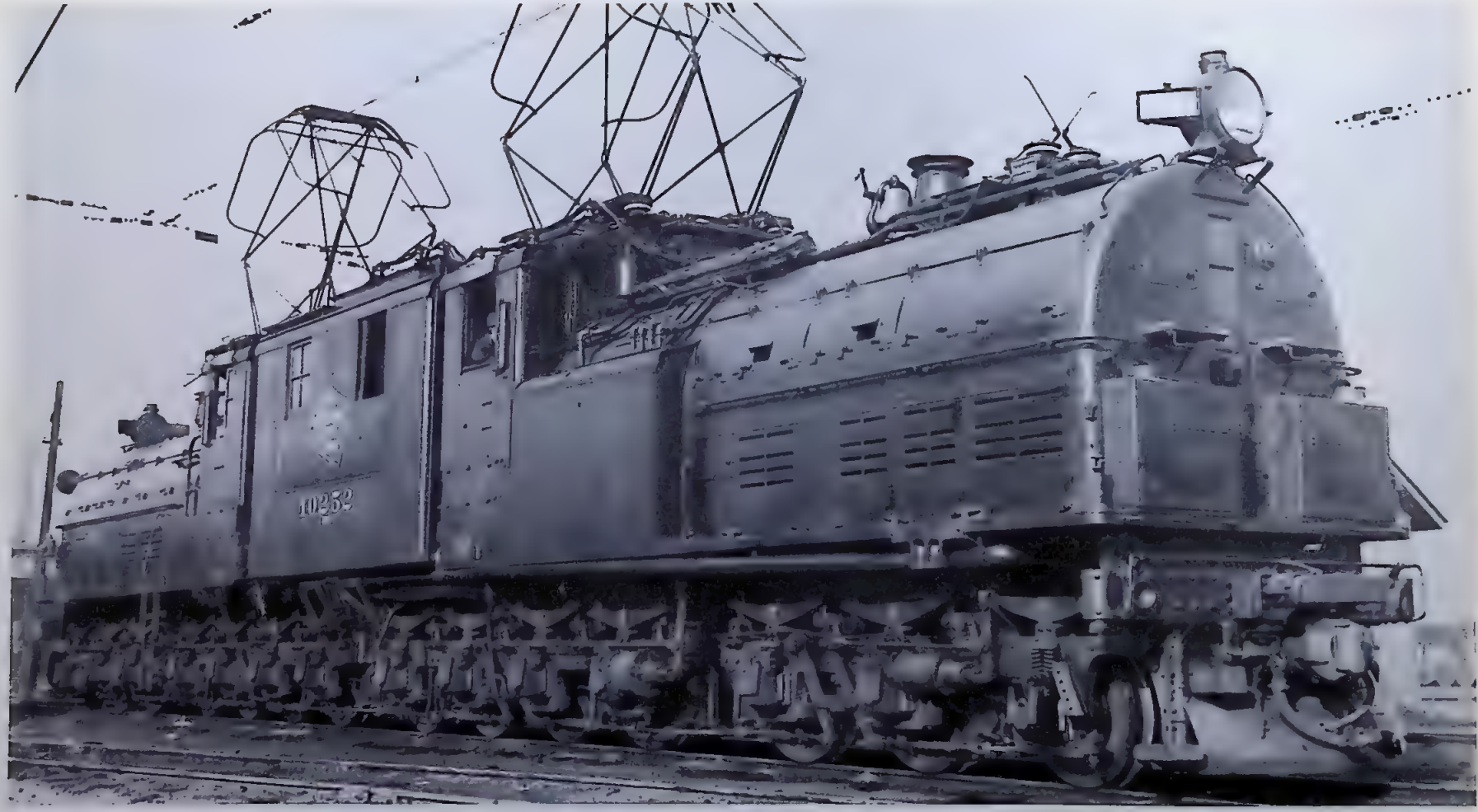
Details of pantograph arrangement, lowered and raised, with view of the center body of the locomotive in middle photo./Photos by Custom Brass.

replace their steamers with catenary and highly efficient "juice jacks." The Milwaukee hoped that these locomotives, as symbols of a commitment to the newest and the best in service, would attract more business. G.E. staged locomotive shoving contests for the press and railroad dignitaries at its test track in Erie, Pennsylvania. The Milwaukee staged more on its tracks at Kent, Washington and high on a curving trestle in the Cascade Mountains. In all cases, the Bi-Polar easily shoved the struggling steam locomotives off stage. These publicity stunts and a grand tour of the Milwaukee system made the Bi-Polars a locomotive that the public would remember for years to come.

The Bi-Polars were, however, designed for more than just publicity.

The St. Paul, as the railroad was called at that time, wanted a fleet of well built, state-of-the-art locomotives, specifically

Here the E-1 leaves Seattle on 18 July 1942, pulling the train backwards to Tacoma. This was done to avoid time-consuming wyeing at Seattle. The engine would change ends from the run to Tacoma. /Photo from Albert Farrow collection.

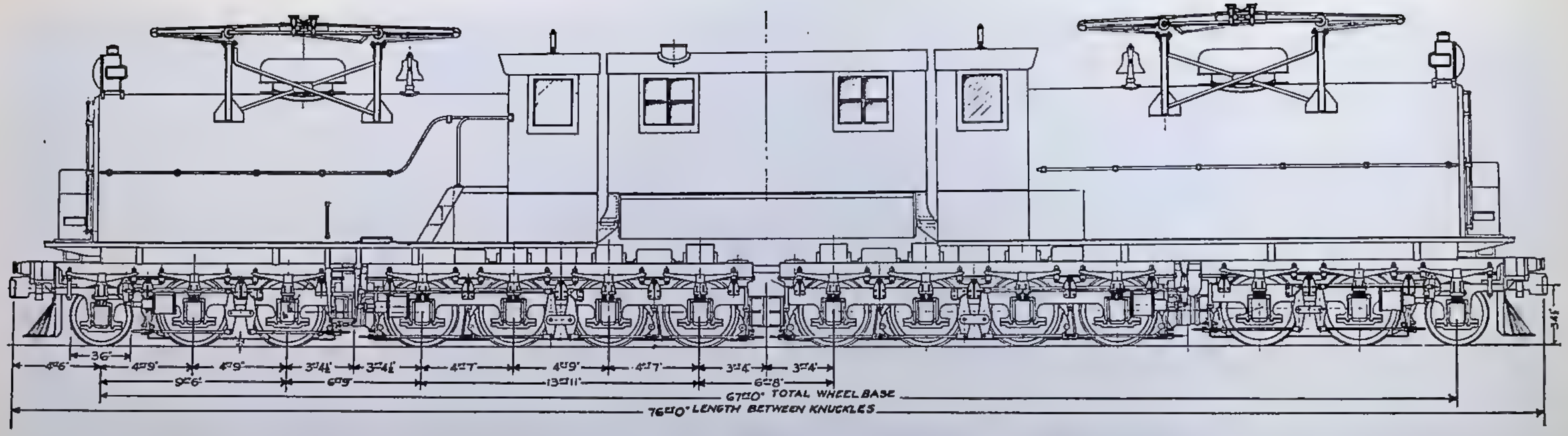


The Milwaukee Road's 10252 at Tacoma, Washington, on 22 October 1937, with both pantographs raised. / Photo from Albert Farrow collection.

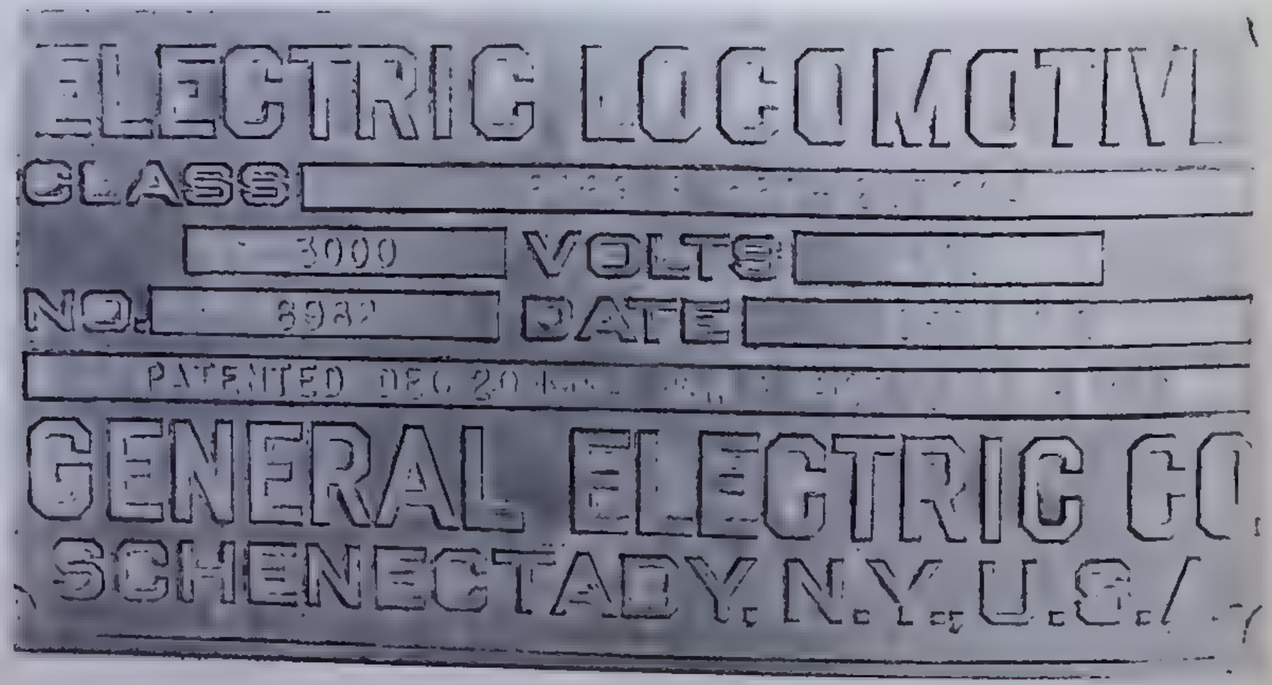
designed for pulling passenger trains in its electrified zones. Already electrified was 440 miles of track which crossed three mountain ranges between Harlowton, Montana and Avery, Idaho. Crews were at work stringing trolley wires above 207 more miles of track in the state of Washington. This track, between the small farming community of Othello and the port city of Tacoma, comprised the mainline of the Coast Division. It crossed two mountain ranges and several weather zones ranging from a bleak desert to forests having heavy snows and rain. Also slated to become an electrified zone was the Idaho Division; 220 miles of twisting but relatively flat trackage which connected the two mountainous divisions. The Idaho

"A BATTLE OF GIANTS," as the G.E. promotion people called it. EP-2 (10253) in a show of strength with two steam locomotives at Kent, Washington, in 1924, easily bested the 7559, a C-3a (2-8-0) consolidation and 9510, an N-1 (2-6-6-2) mallet compound. /G.E. photo.

An early view of the Olympian *in the Cascades, with a full 9-car train. The engine can not be indentified. Note that the cars are fine examples of vintage heavy-weight varnish complete with arched windows and clerestory roofs.* /G.E. photo.



Original design concept for the bi-polar locomotives. Principal change in production models was the relocation of the pantographs to the top of the power unit cabs./General Electric drawing reproduced from *Locomotives and Cars since 1900.*/Courtesy of Simmons-Boardman Publishers Corp.

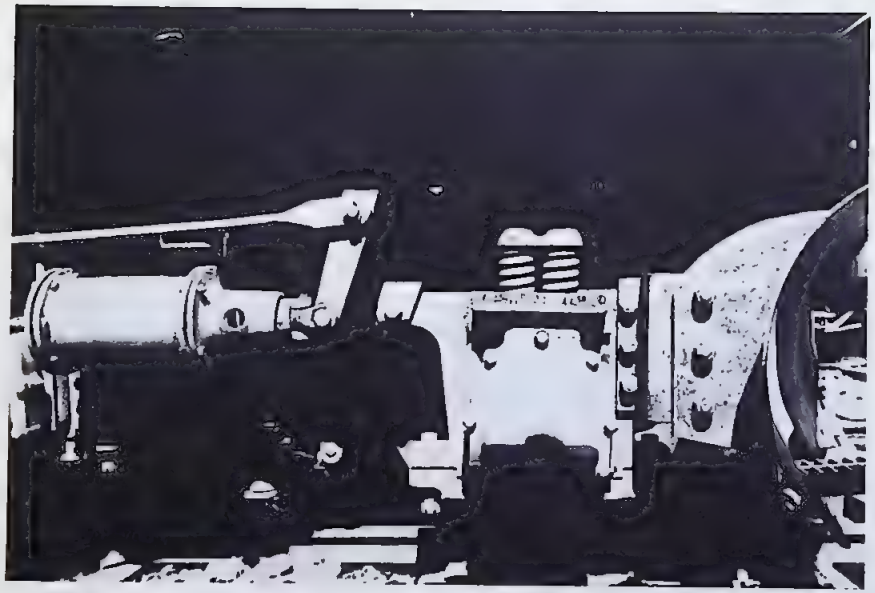


Metal builder's plate from the E-5./Photo from R.V. Nixon collection.

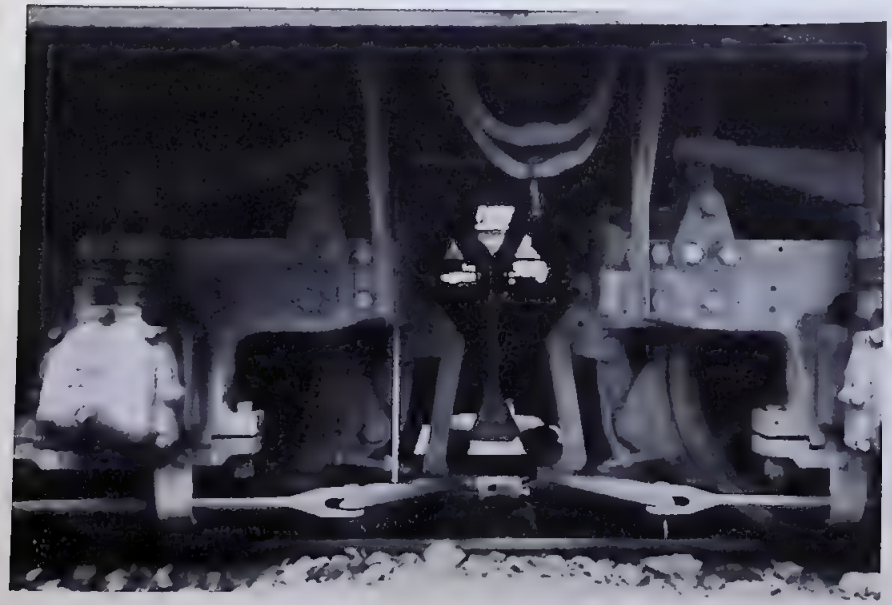
Division never became electric though; the original plans were scotched when the St. Paul went bankrupt in 1923. Though the company quickly reorganized and continued operations as the Milwaukee Road, electrification of the Idaho Division was never again felt to be economically justified. The Bi-Polars would never make a trip from Puget Sound to central Montana traveling all 870 miles under their own power. To the railroad planners in 1917, however, such a trip seemed possible and the Bi-Polars were designed with the versatility to make such a trip.

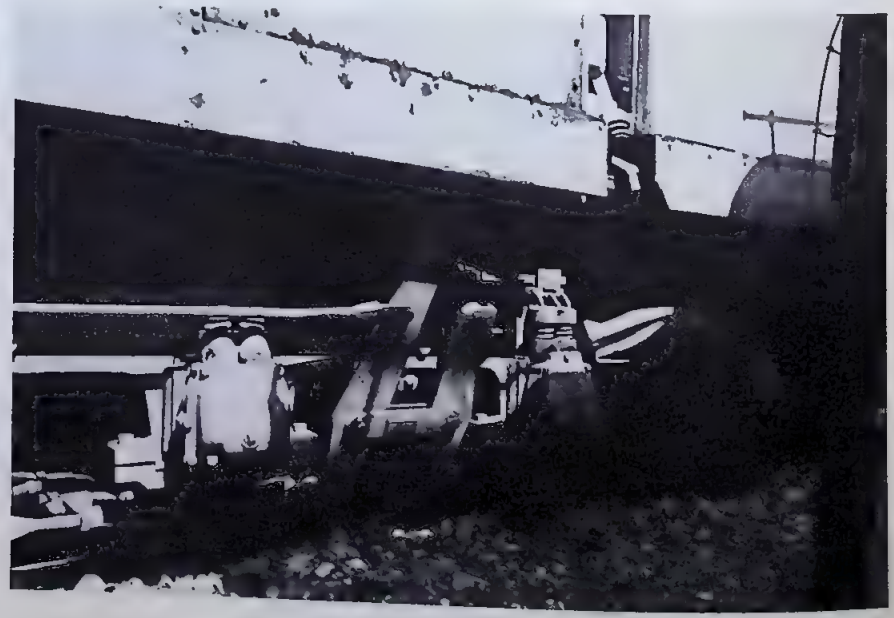
The St. Paul developed specifications for the power, performance and weight it wanted in its passenger locomotives. Then it awarded two contracts for building them. General Electric got the contract for the five to be used on the Coast

The Olympian *is hauled by a double-header, E-2 and E-1, as it leaves Seattle for Tacoma on 29 June 1952. Note the seemingly confusing complexity to the catenery as the train moves effortlessly beneath it.*/Photo by John C. Illman.



This series of five shots show details of the brake rigging and main drive units. Note spoked drive wheels, brake shoes, journal boxes, suspension springs, master brake cylinder and linkage to brake gear./Photos by Custom Brass.





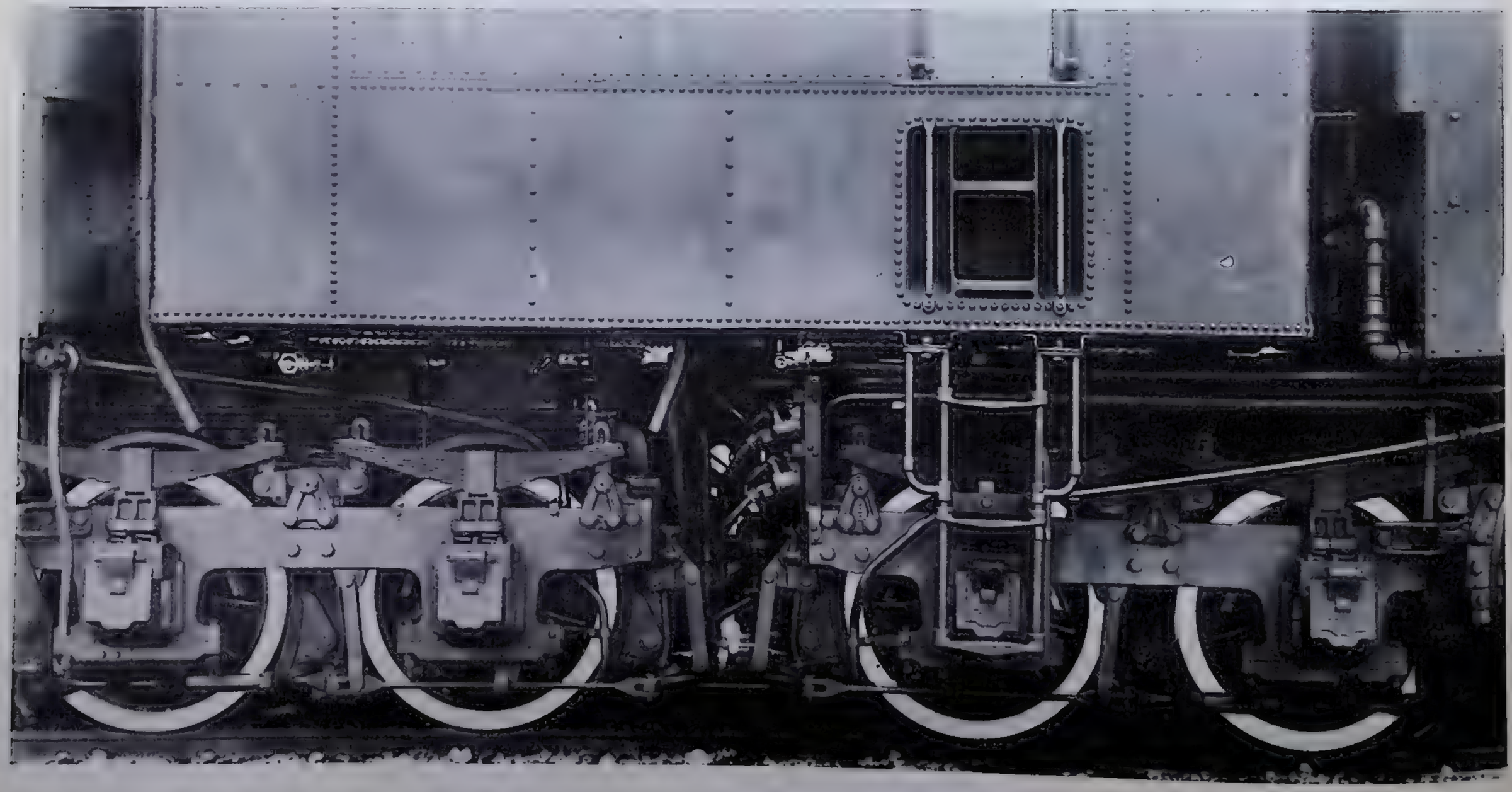
*Interior of a power unit, showing the heavy-duty equipment needed to handle the 3,000 volt power supply. This is number 2 end./*G.E. photo.

Division. Westinghouse was signed for the job of building ten for the Rocky Mountain Division.

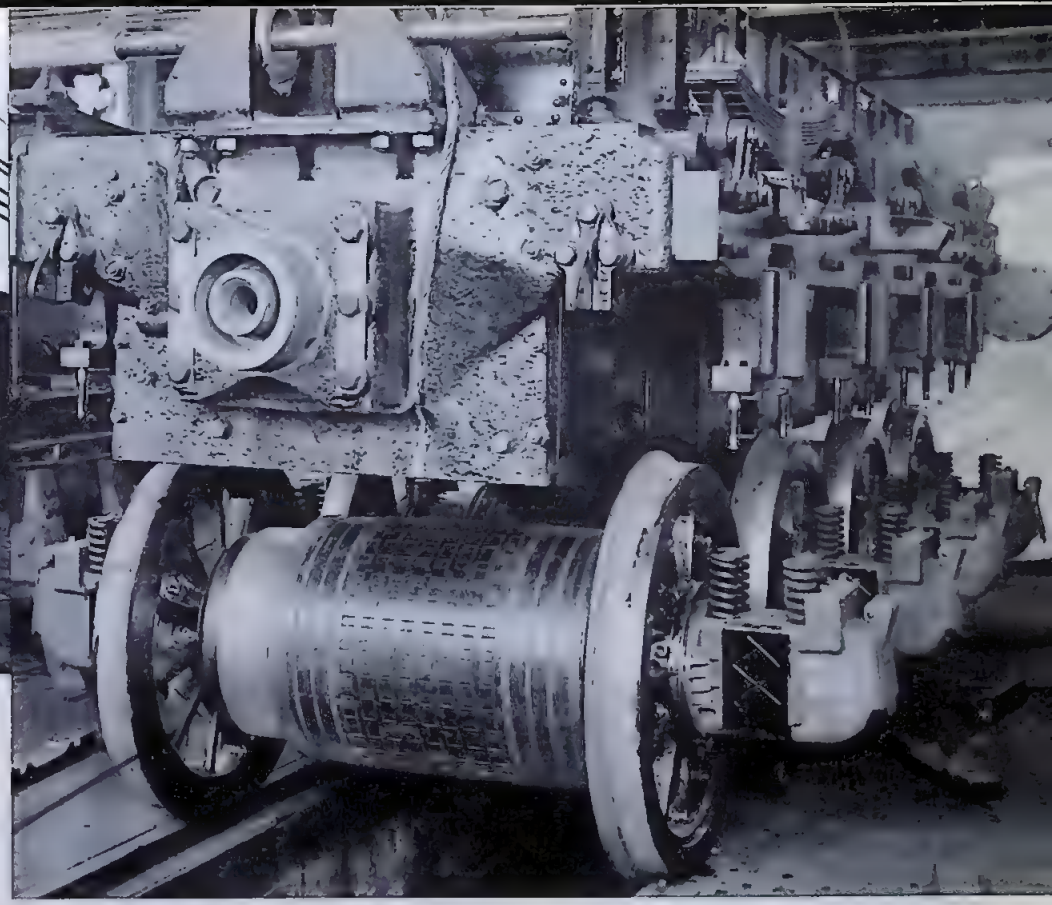
This group which totalled 15 locomotives would constitute the peak of the Milwaukee's electric passenger locomotive fleet. Fifteen wasn't many compared to the 146 passenger electrics that the Pennsylvania once owned. The Milwaukee, however, never had much traffic. Throughout most of the life of electrified passenger service, operations were characterized by two passenger trains a day each way. There were few locals and extras since the Milwaukee served so few real population centers. Only five passenger locomotives were needed on the Coast Division because it was shorter and had less traffic than the Rocky Mountain Division.

The new passenger power from G.E. and Westinghouse began to arrive on the Milwaukee late in 1919. As it did, the twelve 10100 series 2-unit boxcabs which had been hauling

*Here we have a dandy close-up of the running gear beneath the center unit./*G.E. photo.



*Close-up of enlarge snow plow pilot on streamlines unit, E-2./*Photo by Custom Brass.

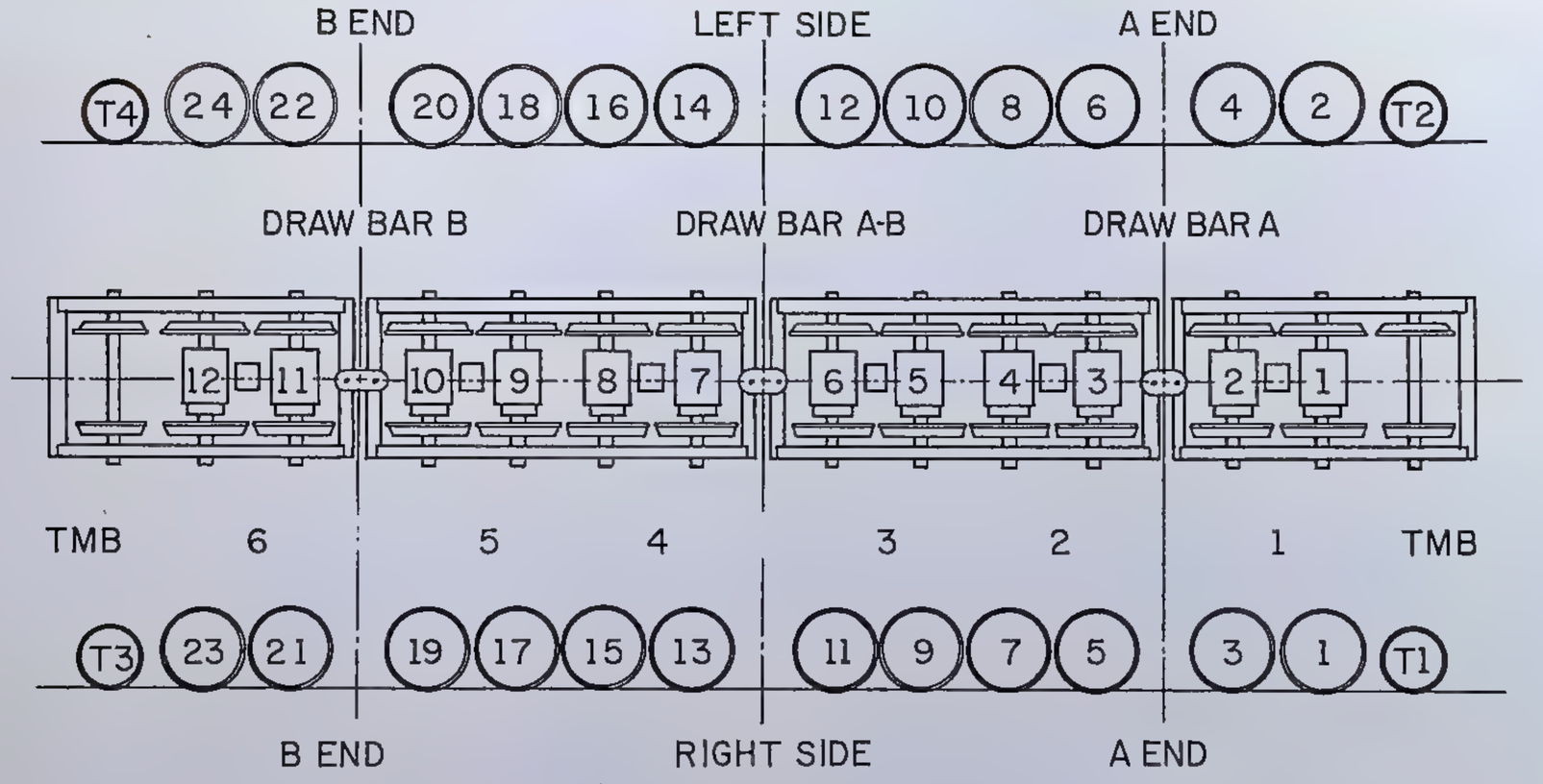


*Details of center drive unit. Note spoked wheels and armature on axle. /*G.E. photo.

passenger trains through the Rockies were regeared and sent to the Coast as freight haulers. The Bi-Polars were briefly tested on the Rocky Mountain Division and then they were also forwarded to the Coast. When they arrived, they proved to be an instant success. They easily met the expectations of both their builders and buyers. They had the power and speed to move silk trains on schedules that steam locomotives couldn't equal, and the sure-footedness to lift 13 heavy pullmans up a 2.2% grade. What is more, they possessed regenerative braking. They could turn their motors into generators while descending mountain grades and slow their trains by generating electricity for the power grid instead of just making brake smoke for the wind. Their excellent performance was the direct cause of their long and useful service life which stretched for forty years.

BI-POLAR TECHNICAL DETAILS

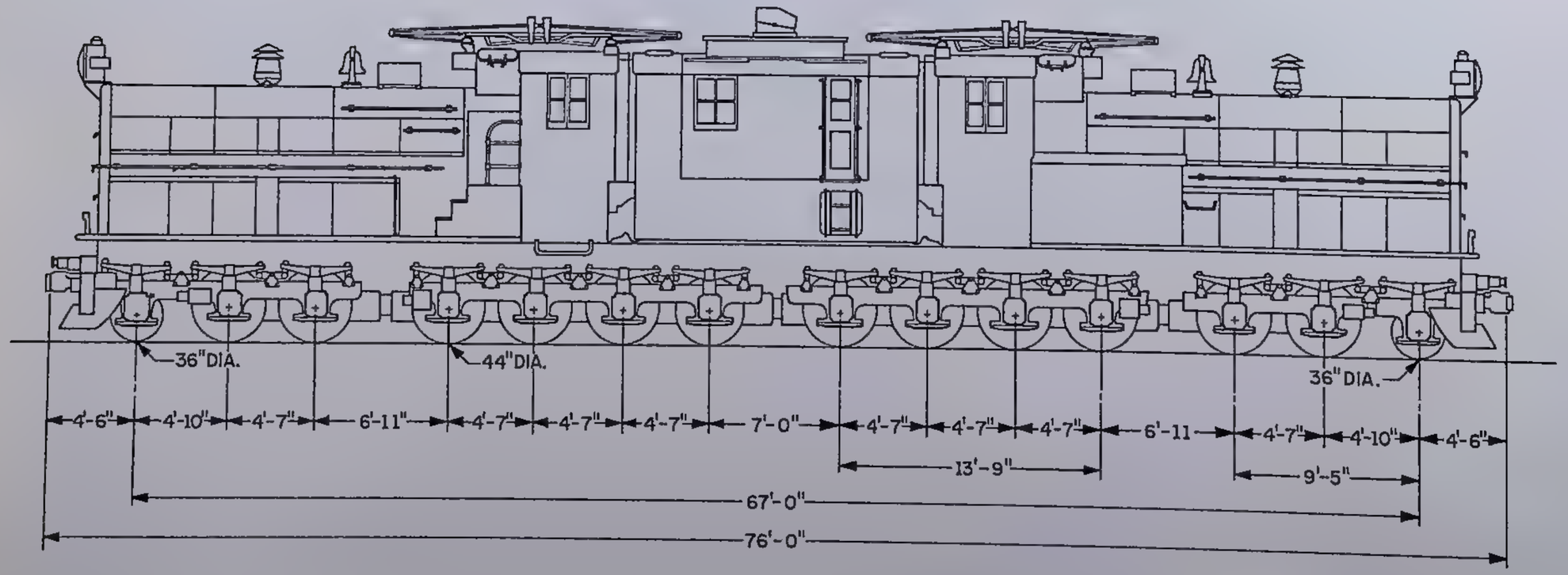
The Bi-Polars were designed and equipped by General Electric, but the running gear was built by ALCO, the American locomotive Company. They were assembled at General Electric's locomotive shop in Erie, Pennsylvania. The resultant machine was 76 feet long, weighed 265 tons and



Section 5.

Wheels on these locomotives are numbered for convenience as shown below. Odd numbers are used on the right side and even numbers are used on the left side beginning on the A-end toward the rear. Truck wheels are given a prefix letter "T." Journals, journal boxes, box plates, brake shoes, hubs, etc., take numbers from the adjacent wheel.

Pantographs are lettered "A" on A-end and "B" on B-end. Pantograph shoes are numbered 1 to 4 beginning on the A-end toward B-end.



Section 6.

CLASS EP-2 ELECTRIC LOCOMOTIVES

Passenger Service — 3000-volts d. c. — Regenerative Braking — 12 Bipolar gearless traction motors, Type GE-100.

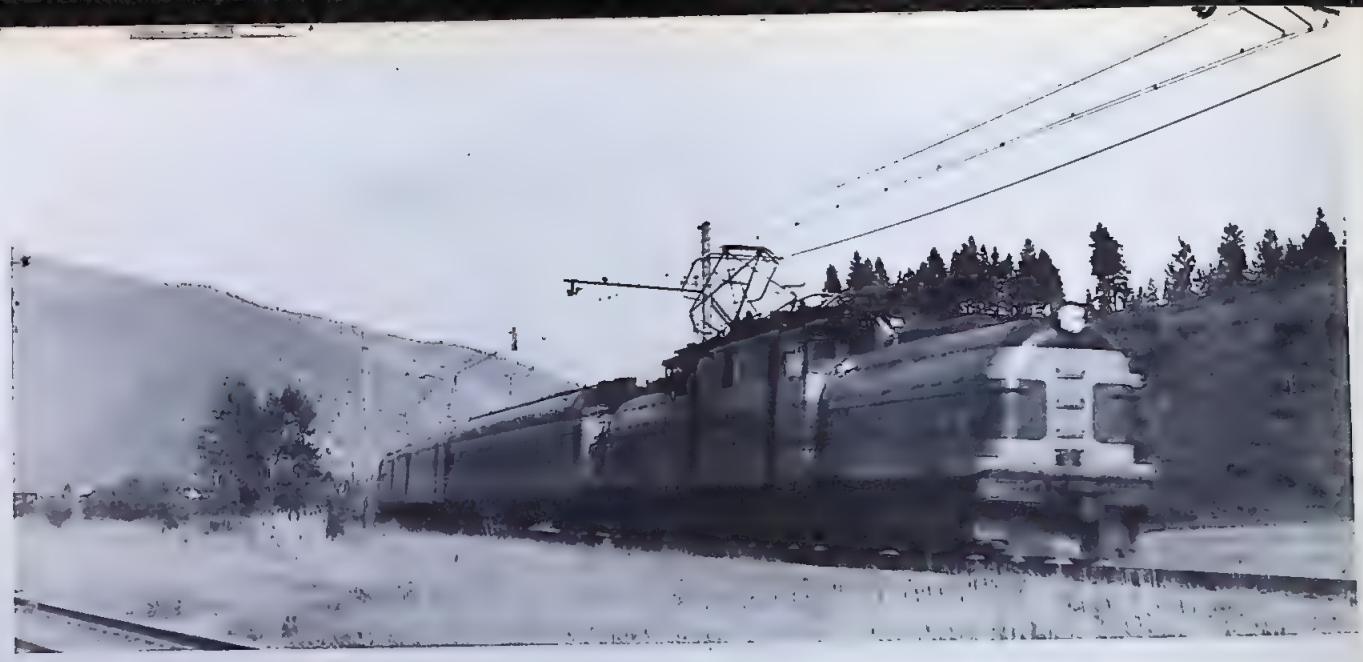
Page from official operator's manual showing wheel orientation, traction motors and reference dimenions. /Courtesy Noel T. Holley.

Photos from Custom Brass collection.

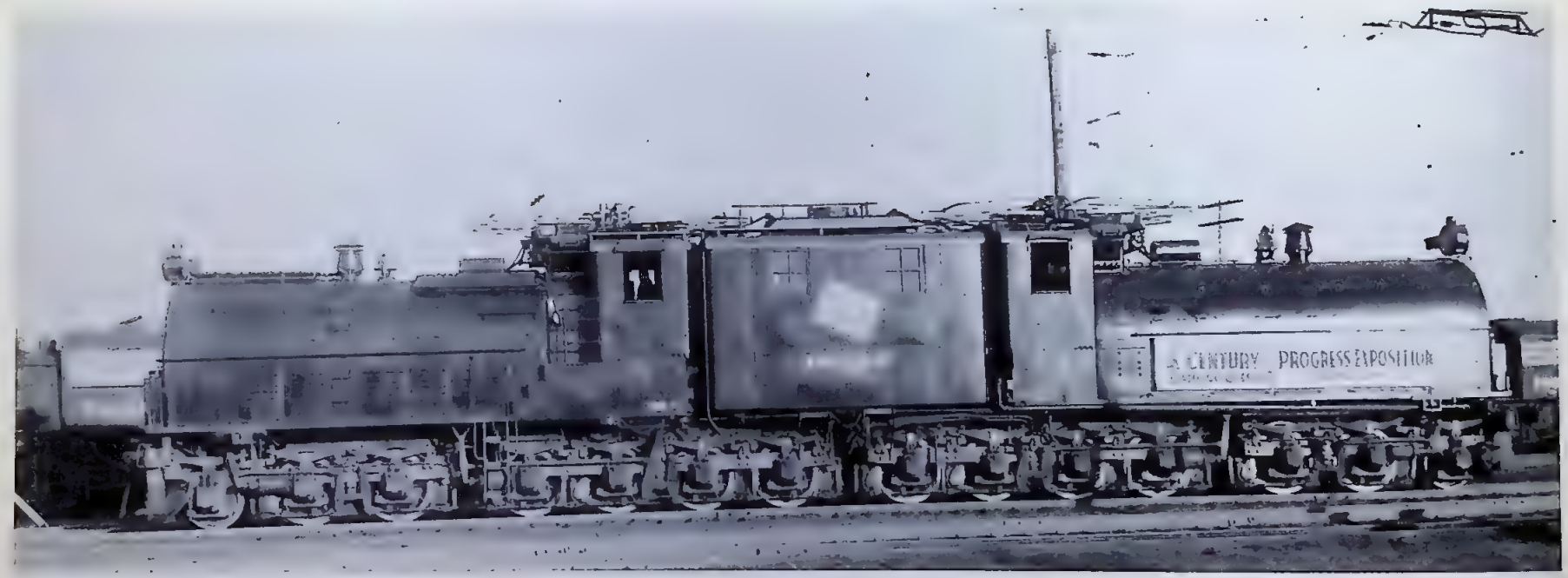
carried 229 of those tons on its driving wheels. Its width was 10 feet and the height over locked-down pantographs was 16'8''. The tallest part of the locomotive was, however, the smoke deflector on the train-heat boiler. The height over that was 17'3''.

The total wheel base was a flexible 67 feet and the ridged wheel base was 13'9''. The wheel arrangement was 1-B+D+D+B-1. What this described was a 4-truck running gear where the lead truck contained three axles. First there was a guiding axle with idler wheels and behind that were two

Once a Milwaukee train left the plains states, headed west, it passed lots of scenery but not much else. These views show the E-4 at Bonner Junction, Montana, 26 May 1957 (top), and the E-1 with train no. 16 on the long grade into Missoula, Montana, on 17 July 1958./Both photos from R.V. Nixon collection.



Out where the west begins, a bipolar hauls Train no. 15 into Primrose, Montana, on 25 May 1957 (top). With the mountains behind it, the E-5 rolls on the level as it enters Tacoma, Washington, on 9 June 1952./Both photos from Albert Farrow collection.



Bound for the fair, the Milwaukee Road's locomotive 10250 carried a banner publicizing the Century of Progress Exposition at Chicago in 1933, where she considerably outranked John Deere and Fordson tractors as an attraction. / Photo by Milwaukee Road.

motorized axles with driving wheels. That truck was followed by a four axle truck where all eight wheels were drivers. These were followed by another such four-axle truck and then another three-axle truck.The idler wheels on each end of the locomotive were 36'' in diameter and made of pressed steel. The drivers were 44'' in diameter and had steel tires fitted around spoked centers.

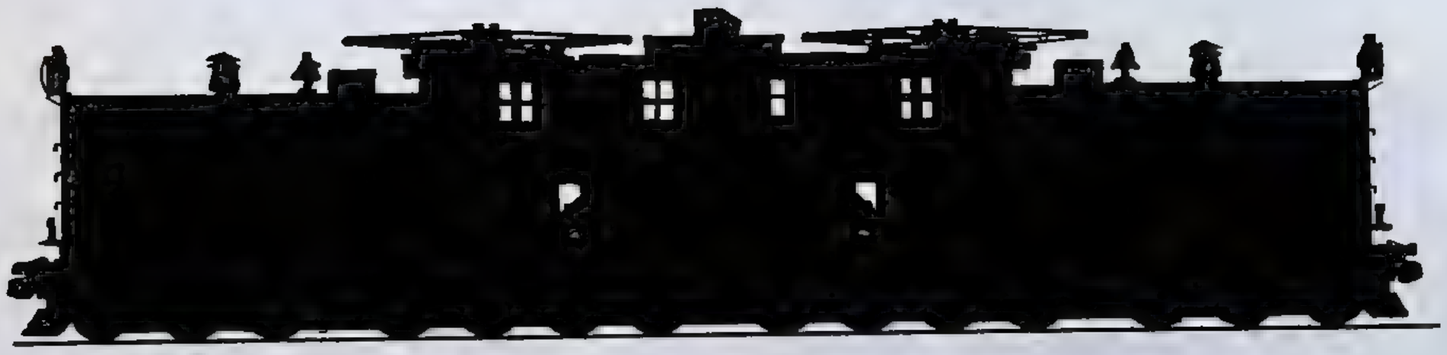
All four trucks were connected together by swiveling ball and socket drawbars which carried the pulling force between trucks and couplers. Unlike latter day diesels, the superstructure of the Bi-Polars simply rode on the trucks. It did not serve as their pivet point and did not carry any pulling stress.

The body of the locomotive was in three sections. The center section was a compartment containing a vertical fire-tube boiler plus 3600 gallons of water and 750 gallons of fuel oil. These provided steam heat for the passenger trains. This section was not attached to the chassis, but instead supported by brackets on the end sections of the body. The end sections contained nearly identical cabs, and in front of the cabs were long, rounded equipment hoods.

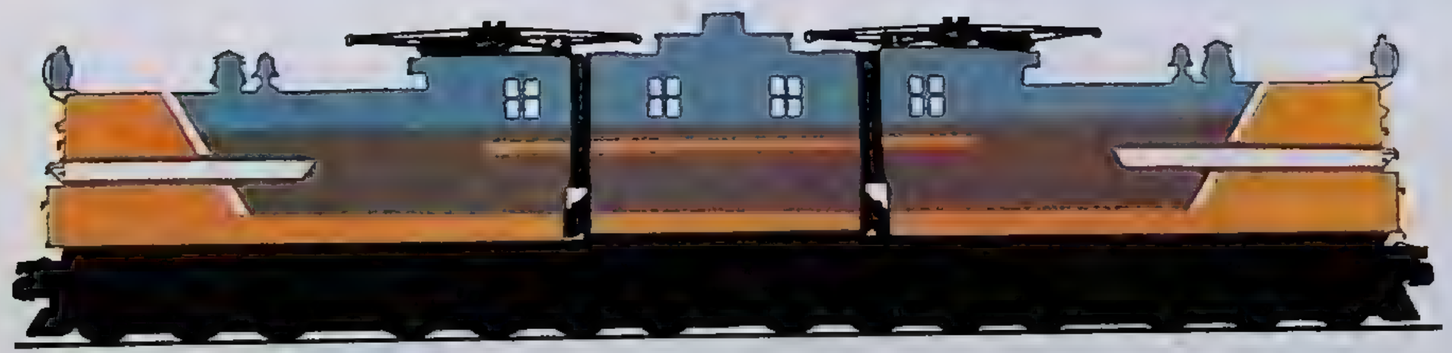
Inside these hoods was electrical gear arranged around an aisle-way which ran the length of the hood. The gear consisted of such things as contactors, control circuits, a lightning arrestor, and in the ''A'' end, a motor generator set. The M-G set used a 40 horsepower, 3000 volt dc motor to turn an 80 volt dc generator which provided current for train lighting and low voltage equipment on the locomotive. The Bi-Polars contained one air compressor and this was carried on the right hand side of the ''B'' end hood. It was located in the rectangular box just ahead of the cab.

E-1 Deer Lodge, Montana, April 29, 1958./Photo by Monty Powell. Collection of John Harrigan.

The Milwaukee Road's Olympian, *powered by the E-4, pulls out of the old Tacoma, Washington, depot on 25 April 1949.*/Photo from Albert Farrow collection.

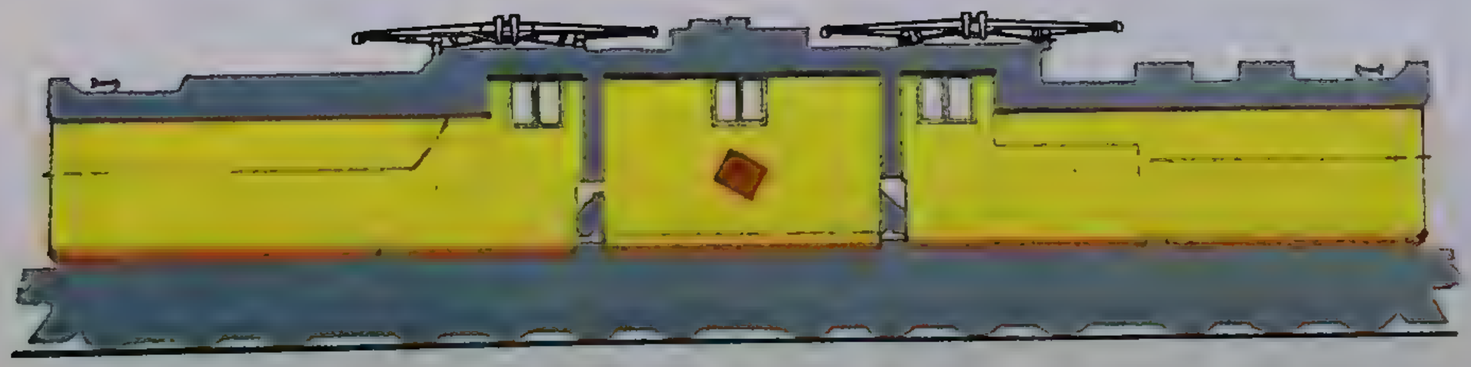


As delivered, and for several years up until 1948, the Bi-Polars were finished in black livery with white lettering.



In 1948 the railroad decided that they should carry a more picturesque scheme more suitable to passenger operations. At left is one of the various intermediate schemes.

The colors became standardized in 1955, in keeping with diesels and to match the strings of modern varnish which would trail behind. The scheme was carried over after streamlining in the late 50's.



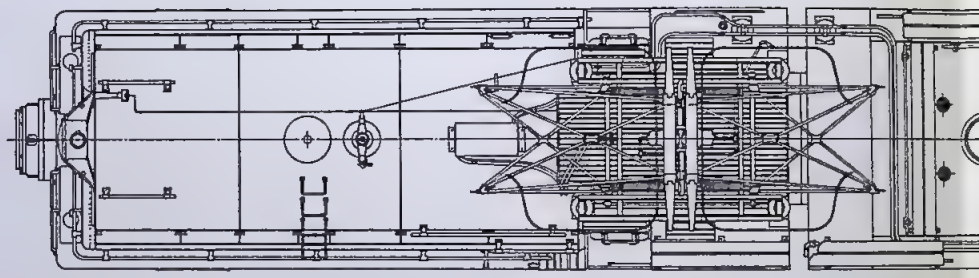
Because of connections with the Union Pacific, the locomotives were yellow and grey to correspond with U.P. equipment.

MILWAUKEE ROAD BI-POLAR

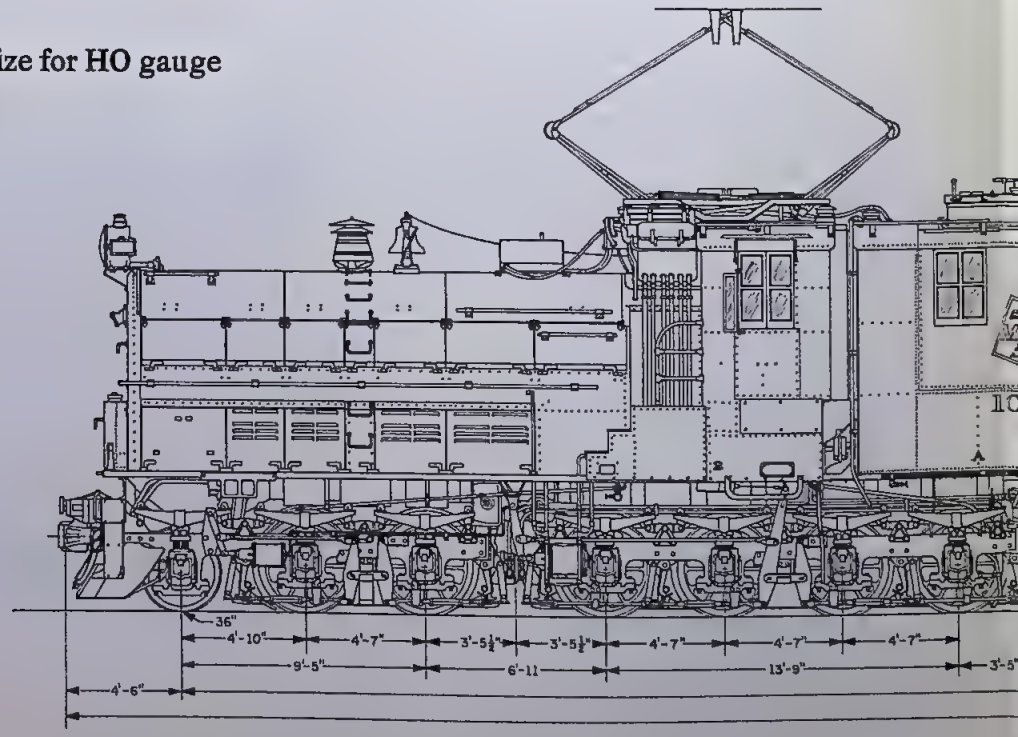
Road class EP-2 No. 10252

1-B-D+D-B-1 Type

(General Electric 1919)

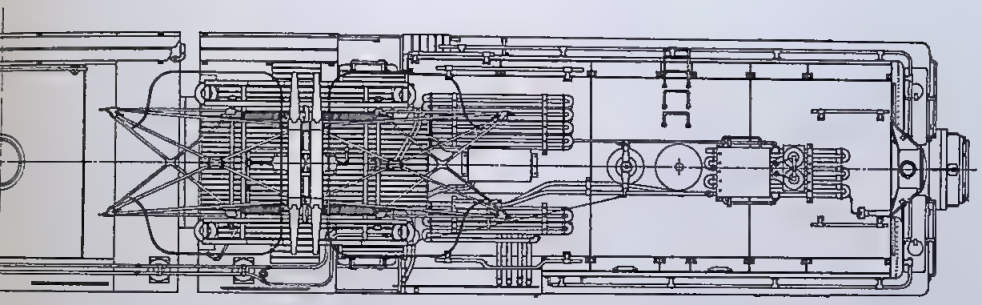


Scale: 3.5mm = 1'-0'' (1:87) Full size for HO gauge

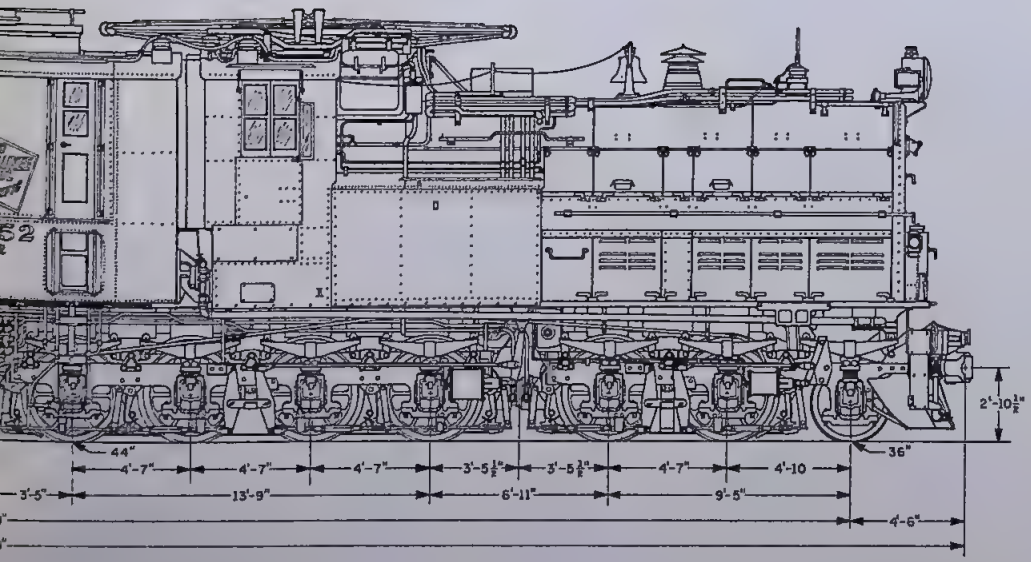


Drawn by Alan B. Chesley, © Copyright 1979, N. J. International, Inc.

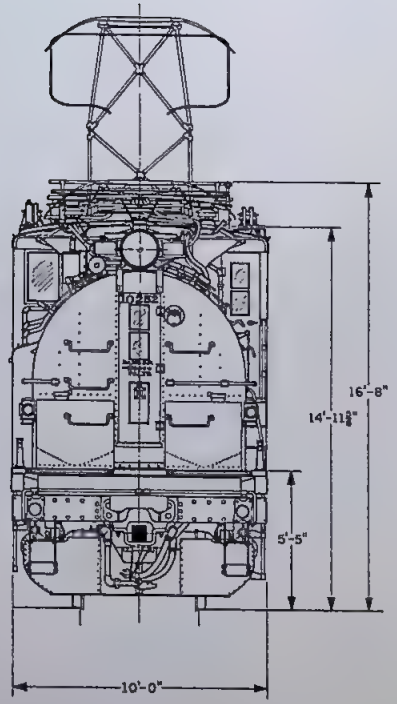
SIDE E



TOP VIEW



VATION



FRONT OF ENGINE

MILWAUKEE ROAD BI-POLAR 1-B-D+D-B-1 Type

Road class EP-2 No. E-1 (General Electric 1919)

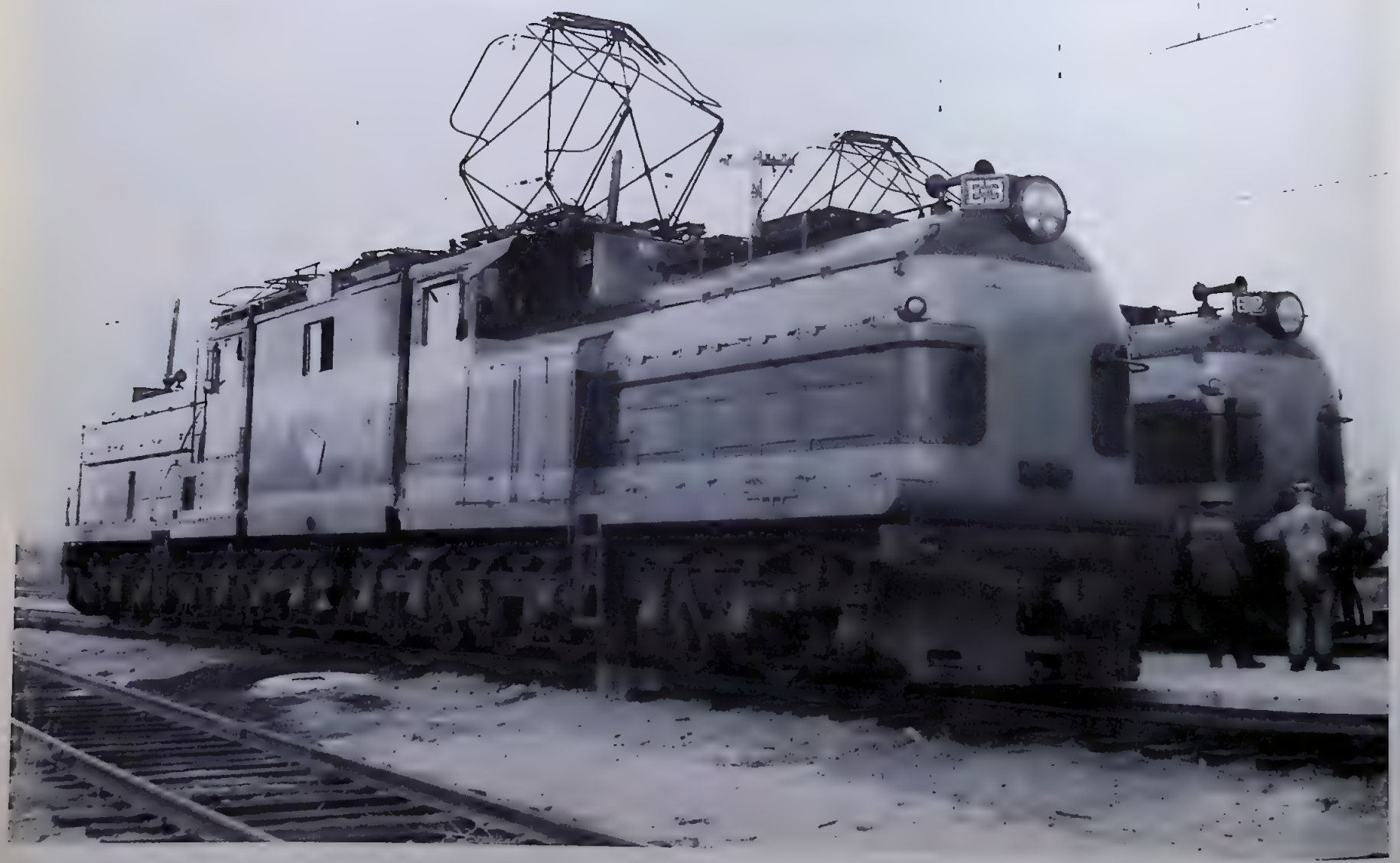
SIDE ELEV

Rendering by Alan B. Chesley, © Copyright 1979, N. J. International, Inc.

Scale: 3/16'' = 1'-0'' (1:64) Full size for S gauge

ATION

FRONT OF ENGINE



An unusual view of the E-2 and E-3 at Deer Lodge, Montana, on 28 March 1958. Because there were only five of the bi-polars in operation, it was seldom that two of them showed up at the same time and place./Photos from R.V. Nixon collection.

The locomotive E-2, hauling Train 15, pauses at Deer Lodge, Montana, on 28 March 1958, where the biggest building in town was the grain elevator.

The Milwaukee Road's locomotive E-4 heads out of the old Tacoma, Washington, depot on 25 April 1949./Both photos R.V. Nixon collection.

Photos from Custom Brass collection.

Photo from Dave Elhardt collection.

Photo from Custom Brass collection.

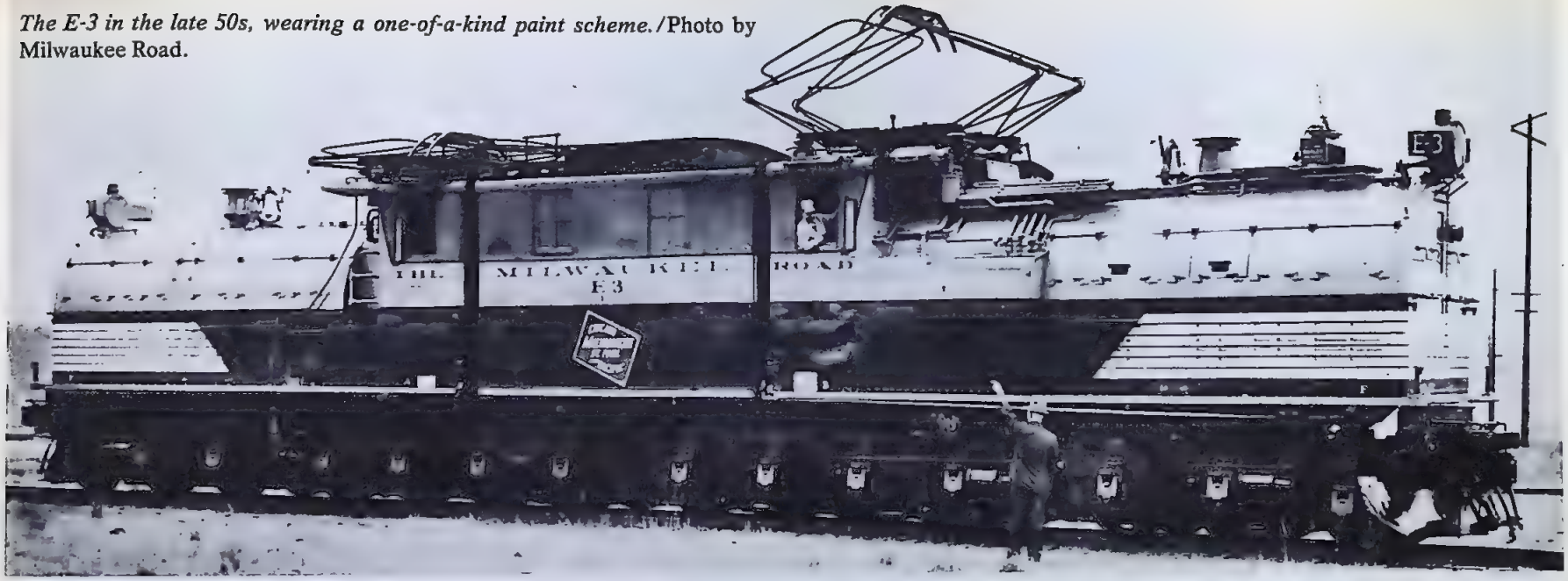
The end sections of the Bi-Polar's body were rigidly bolted to the four axle trucks, below the cabs. Their weight also rested on the three axle trucks, but this was through a set of rollers running on an inclined rack. Besides carrying weight, the rack and rollers acted as a truck centering device. As the locomotive entered a curve, the guiding truck would swing from its spot directly beneath the end of the hood. When it did this, the end of the hood was lifted slightly by its rollers moving up the inclined rack. The lowest point of the rack was the center. When the locomotive left the curve, gravity pulling down on the hood would work to move the guiding truck back to the center point beneath the hood.

Mounted on top of each cab was a pantograph that could reach as high as 26 feet, and function as low as 18 feet. Though the Milwaukee Road's normal maximum trolley wire height was 24'2", the pantographs could handle any reasonable deviation.

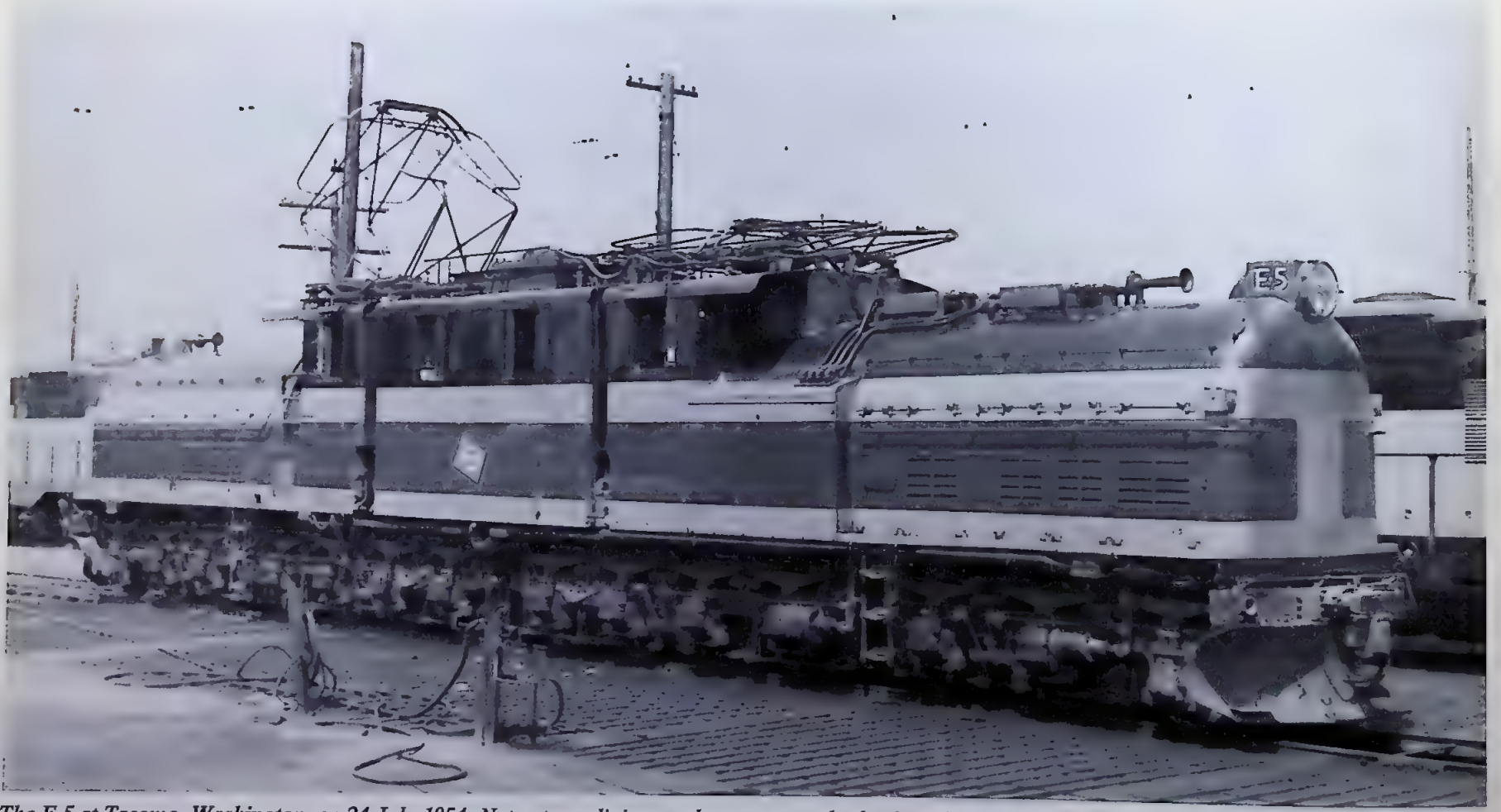
The motors on the Bi-Polar were designed to operate at 1000 volts each. There were 12 of them, each was rated at a maximum of 266 horsepower. The motor armatures and

Milwaukee Train no. 15, hauled by E-5, arriving at Auburn, Washington on 2 August 1940./Photo from Albert Farrow Collection.

The E-3 in the late 50s, wearing a one-of-a-kind paint scheme./Photo by Milwaukee Road.



The E-4 at Tacoma, Washington, on 3 June 1950, gets her running gear hosed down. Note the exhaust from steam boiler in the center unit./Photo from Albert Farrow collection.



The E-5 at Tacoma, Washington, on 24 July 1954. Note streamlining, and standard paint scheme for that time. /Photo from Albert Farrow collection.

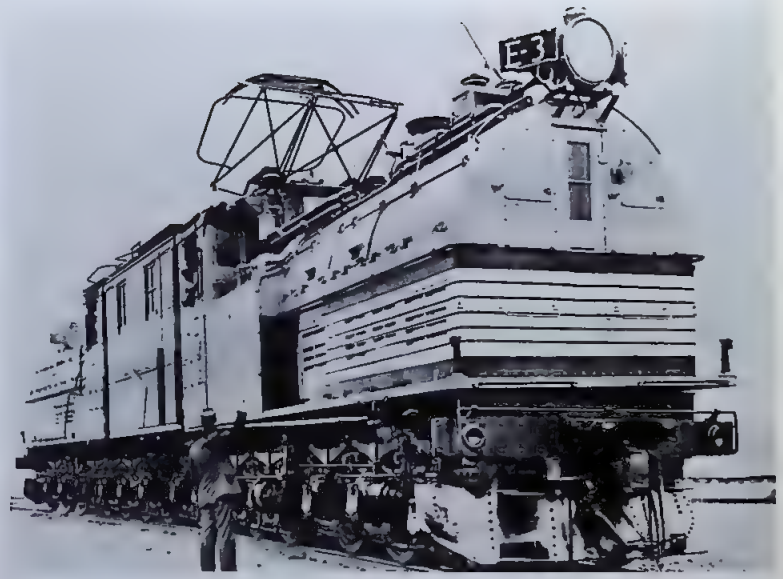
commutators were mounted directly on the axles. The field poles were mounted on the chassis and there were two poles for each motor.

Acceleration and deceleration of the motors was controlled with resistors, however these were only used in moving between the locomotives four regular operating speeds. The lowest of these speeds was series. In series all 12 motors formed a chain linking the trolley wire which carried 3000 volts dc and the rails, which were grounded. Each armature thus received only 250 volts. In Series-Parallel there were two groups of 6 motors in series and each received 500 volts. Low Speed-Parallel, meant the motor grouping was 4-4-4 and each received 750 volts. High Speed parallel made it 3-3-3-3 and gave each motor a full 1000 volts. To achieve an even higher

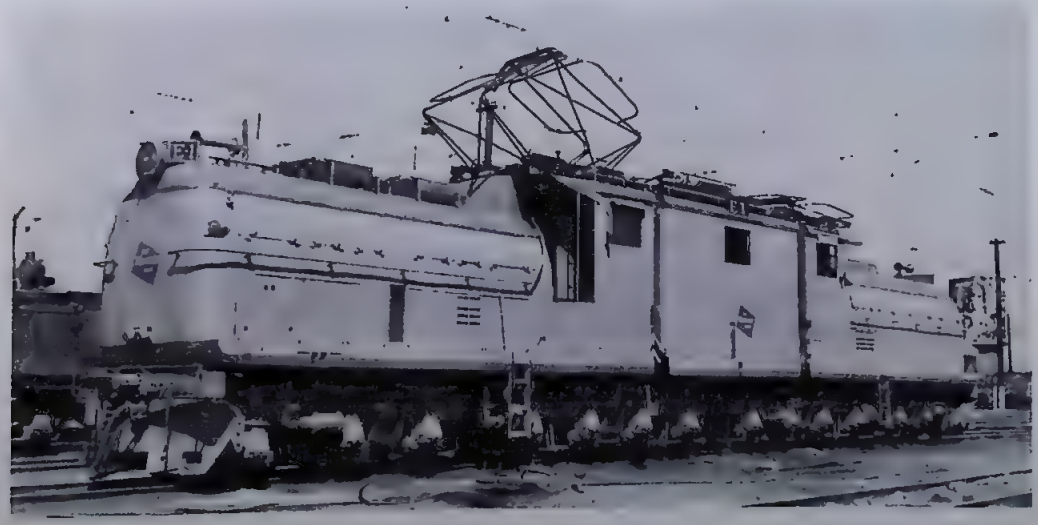
E-3 posing on the service track after delivering her charge at Deer Lodge, Montana on April 29, 1958. /Photo from Monty Powell collection.

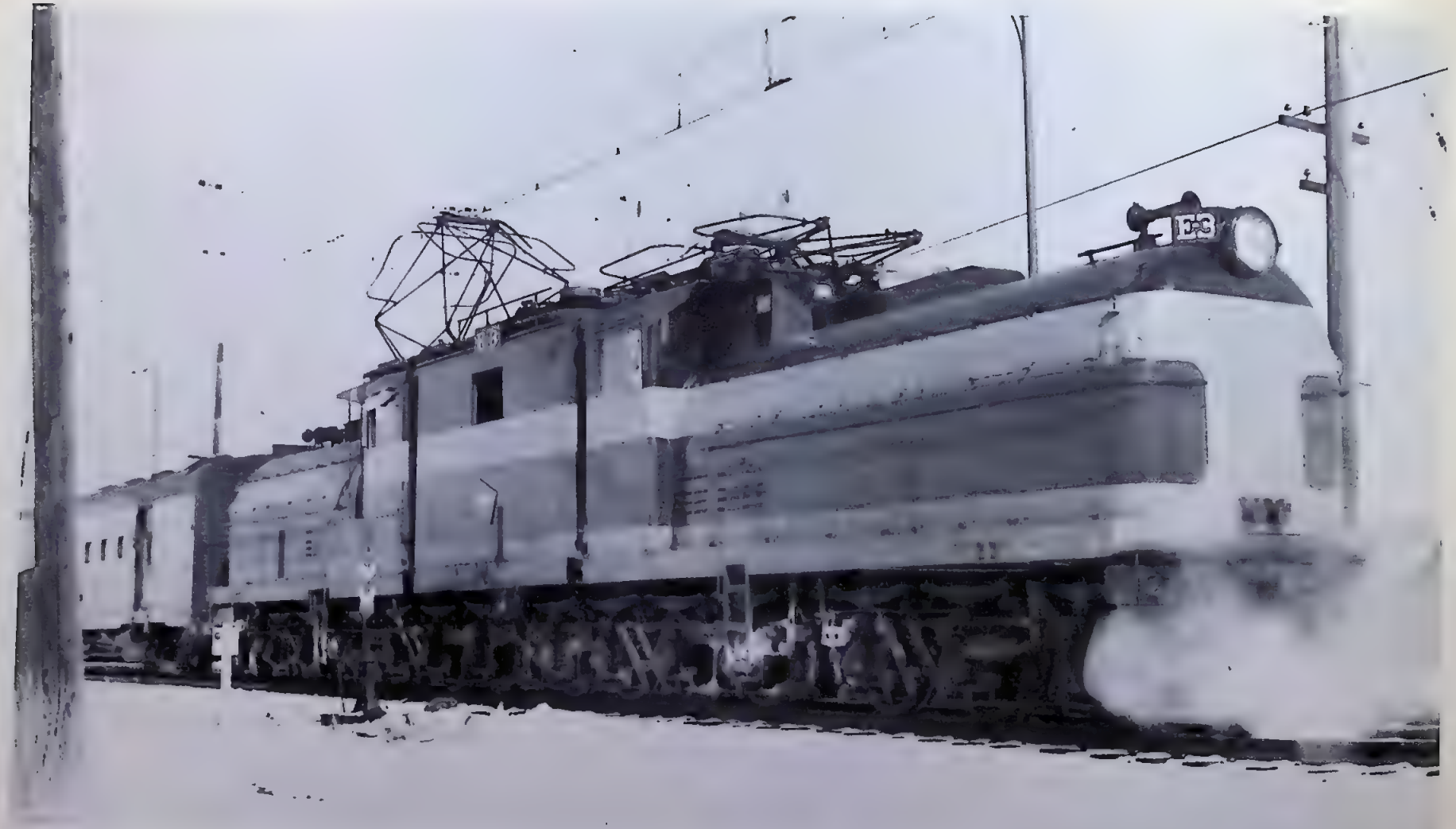
While the E-3 stops at Missoula, Montana, on 15 June 1957, an engineer does a walk-around inspection of the running gear./ Photo from R.V. Nixon collection.

*The E-3, with Train no. 16, at Three Forks, Montana, on 28 June 1959./*Photo from R.V. Nixon collection.



Over the years the bi-polar locomotives had several face lifts and new paint jobs to keep them abreast of the times. The E-3 is shown (top) in original configuration and center, with up-dated color scheme and markings. The E-1, bottom, presents a much cleaner appearence. /Photos from Harold K. Vollrath collection.





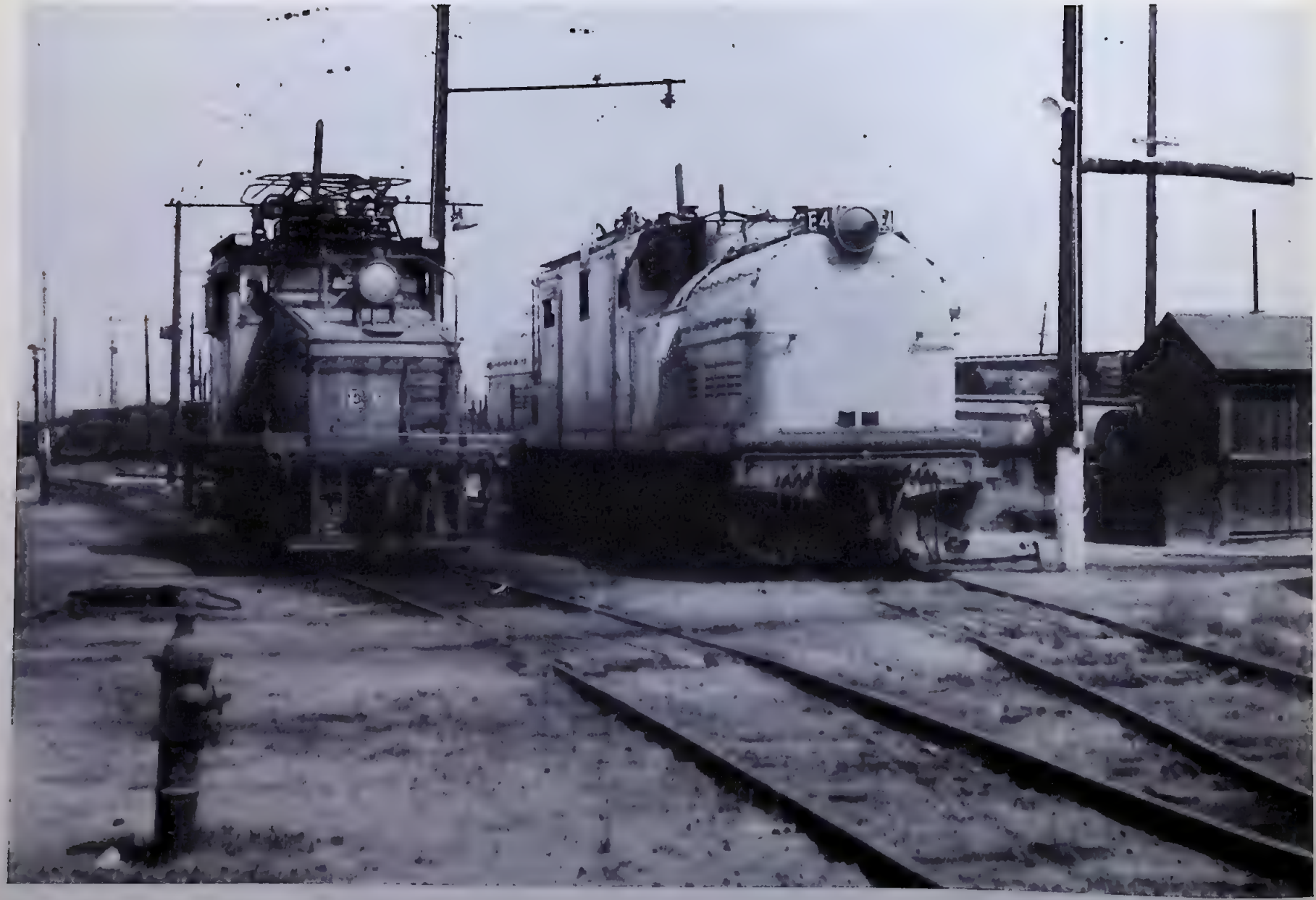
The streamlined E-3 hauling varnish through Butte, Montana, in April 1958./Photo from Harold K. Vollrath collection.

speed under light load conditions, the motors could be put in a shunt. A shunt allowed current to flow through only half of each field pole. This gave increased speed and less tractive effort—something of value when the locomotive was in flat trackage where high tractive effort wasn't needed.

Amperage drawn by the locomotive was directly related to the tractive effort being produced. For instance, of starting required 118,000 lb. of tractive effort, then the locomotive drew 6,000 amps while starting. During normal running, the locomotive produced 42,000 lb. of tractive effort and drew 888 amps.

The E-2 at Deer Lodge, Montana, on 28 March 1958./Photo from R.V. Nixon collection.

The E-5 at Deer Lodge, Montana, on 2 May 1957./Photo from R.V. Nixon collection.



Out of service and shunted to the boondocks, the E-4 sits on a side track at Deer Lodge, Montana, in August, 1961. The engine was retired in January of that year. The E-81 is a steeple cab type switcher. /Photo from collection of James T. Hehrman.

The Bi-Polars were designed to pull any normal Milwaukee Road passenger train singly and thus were built without multiple-unit controls. If any train exceeded their capacity, they had to be double headed with a crew in each locomotive. Multiple-unit controls were not added until the Bi-Polars received a major rebuilding in 1953.

PERFORMANCE

Some performance statistics commonly stated by the Milwaukee Road are as follows:

Continuous horsepower	3200
Continuous tractive effort	42,000 lb.
Speed for continuous ratings	28.4 mph
One-hour horsepower rating	3500
One-hour tractive effort rating	48,500 lb.
Speed for one-hour ratings	27.1 mph
Maximum starting tractive effort	123,500 lb.
Maximum safe speed	70 mph

Overheating of the traction motors is the factor which limits electric locomotive power outputs. Minor differences between the above statistics and others quoted over the years by G.E. and the Milwaukee, reflect experience. For instance, the locomotive designers at General Electric estimated that Bi-Polars could produce 2760 horsepower continuously and pull a 960-ton train over a 2.2% grade. The Milwaukee's experience showed 3200 hp on a 1,150-ton train. Rebuilding the locomotives and increasing the trolley voltage from 3000 to 3300 also produced changes.

The E-1 rolls into Renton, Washington, on a warm July afternoon in 1941. Note lawn sprinklers at right./Photo from Albert Farrow collection.

The eastbound Olympian, hauled by the bi-polar E-3, at the handsome Romanesque-style station in Missoula, Montana, on 19 June 1958. / Photo from R.V. Nixon collection.

ROSTER

Original Number	Number After 1939	Entered Service	Retirement Year	Disposition
10250	E1	1-27-20	1962	Scrap
10251	E2	1-11-20	1962	Museum
10252	E3	12-15-19	1962	Scrap
10253	E4	1-13-20	1962	Scrap
10254	E5	1-27-20	1962	Scrap

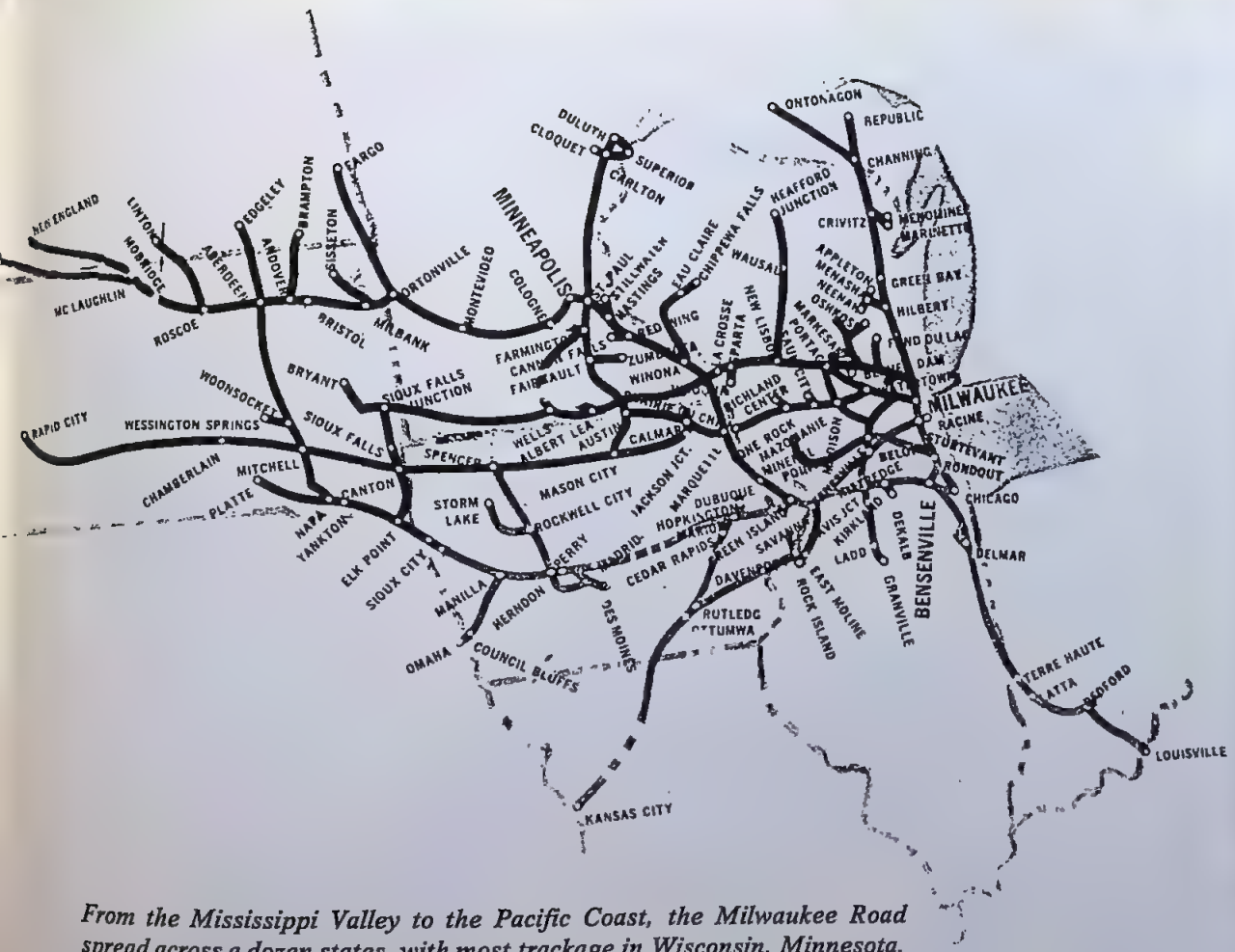
TONNAGE RATING IN CARS, AS PER 1928 OPERATORS MANUAL

GRADE	LOCATION	PASSENGER CARS
2.2%	WB, Beverly—Boylston	12 cars
1.74%	EB, Cedar Falls—Hyak	14½ cars
1.6%	EB, Kittitas—Boylston	15 cars

FREIGHT SERVICE LIMIT

50 cars, all locations. Limit imposed because locomotive has only one air pump.

(AUTHORS NOTE: Bi-Polars seldom used in freight service and only for short fast trains. They could not be mixed with freight power, and could not be regeared for freight service. Weak frames and the fact that there were only 5 of them prevented using them in threes and fours for heavy freight trains.)



From the Mississippi Valley to the Pacific Coast, the Milwaukee Road spread across a dozen states, with most trackage in Wisconsin, Minnesota, Illinois and Iowa. About 660 miles of road were electrified for operation through the Belt, Rocky, Bitter Root, Cascade and Saddle mountain ranges.

BI-POLAR FAIR EXHIBITIONS

Century of Progress	Chicago	1933-34
Worlds Fair		
Chicago Railroad Fair	Chicago	1949

A head-on view of a bi-polar locomotive showed it to be clean and uncluttered in design—and made it difficult to determine whether it was coming or going. / Photo from Custom Brass.

Nostalgia and EP-2's. Pictured below various time tables and memorabilia of trains pointed by the bi-polar. /Courtesy of Arnold B. Joseph.

Notes Along the Olympian TRAIL
The Great Scenic Route to the Pacific Northwest
FEB 12 1963
OTTO A. WEISS
32-62 34th STREET
LONG ISLAND CITY, N.Y.
CHICAGO MILWAUKEE ST. PAUL AND PACIFIC
The MILWAUKEE ROAD
Chicago, Milwaukee, St. Paul and Pacific Railroad Company
PASSENGER TRAFFIC DEPARTMENT
CIRCULAR NO. 4603
RULES GOVERNING HONORING OF PASSES
Running Trains with Running Water
How Science Aids the TRAVELER
CHICAGO MILWAUKEE AND ST. PAUL RAILWAY
The World's Longest Electrified Railroad

An unusual sight on the electrified section of the Milwaukee Road—a double-header. The E-1 and E-3 pass through Auburn, Washington, on 4 April 1952. / Photo from Albert Farrow collection.

One of the earliest views of a bi-polar in operation; locomotive 10254 east-bound at Cedar Falls, Washington, in the early 1920s./ Photo from R.V. Nixon collection.

Bi-polar E-1 hauling the Olympian *at Deer Lodge, Montana, 2 May 1957./*Photo from R.V. Nixon collection.

The E-4 at Deer Lodge, Montana, on a cold day in April 1958. / Photo from Harold K. Vollrath collection.

FOR FORTY YEARS THEY RODE THE RAILS

From 1919, through part of 1957, the Bi-Polars operated on the Milwaukee's Coast Division. Their run was from Seattle and Tacoma on Puget Sound, to Othello, which lay 214 miles east in farming country. Their primary work was pulling regular passenger trains. They did, however, handle silk trains in the early days, and occasional excursions. In the 1940s, they also pulled ski trains to the Milwaukee Ski Bowl in Snoqualmie Pass.

As retired engineer, Andrew Rogerson recalls, "The Bi-Polar was quite a motor and it was fast. Sometimes I had them up to 70 mph, as fast as the track would allow. The Bi-Polars would rock you pretty good back and forth as they rolled along though. From Easton to Cle Elum, it's a slight down grade for eleven miles and going at speed over bad

The end of the line, Locomotives E-3, E-5 (above) and E-1 (right) out of service at Deer Lodge, Montana, on 1 April 1962. The sole survivor of the bi-polars is the E-2./Photos from R.V. Nixon collection.

On 25 May 1961 the Milwaukee Road's bi-polar locomotive E-2, the last of its kind, was turned over to the National Museum of Transport in St. Louis. In his presentation speech, F.G. McGinn, Milwaukee Road vice-president for operations, mentioned that the end of four decades of service was a nostalgic occasion, as he had ridden behind the locomotives many times. /Milwaukee Road photo by Emil Bubash.

track, sometimes you would think the Bi-Polar had left the rails."

Laurence Wylie, who retired as the second director of the Milwaukee's electrification, spoke of them fondly. "They were a good locomotive, we had little trouble with them," he said.

The Bi-Polars remained mechanically almost unchanged for the first 34 years of their existence. Beginning in 1953, however, they went through a major rebuilding and upgrading at a cost of $35-40,000 each. The Milwaukee needed improved passenger electrics but it was not about to buy new ones. To solve the problem Laurence Wylie applied his electrical engineering knowledge to the task. E-5 was rebuilt to his specifications at the Tacoma shops. When it emerged, it had a higher top speed, multiple unit controls, roller bearings, a streamlined appearance, and air horns instead of whistles. It also cost more than Wylie initially estimated it would.

Partially because of the cost of the project, the company's top management decided that the rest of the rebuilding work should be done at the main shops. Using E-5 as a model, the crews in Milwaukee, Wisconsin converted the others. The excellent quality of their metal working is apparent from the cleaner lines that E-1 through E-4 rolled out with. The quality of their electrical work, however, left something to be desired.

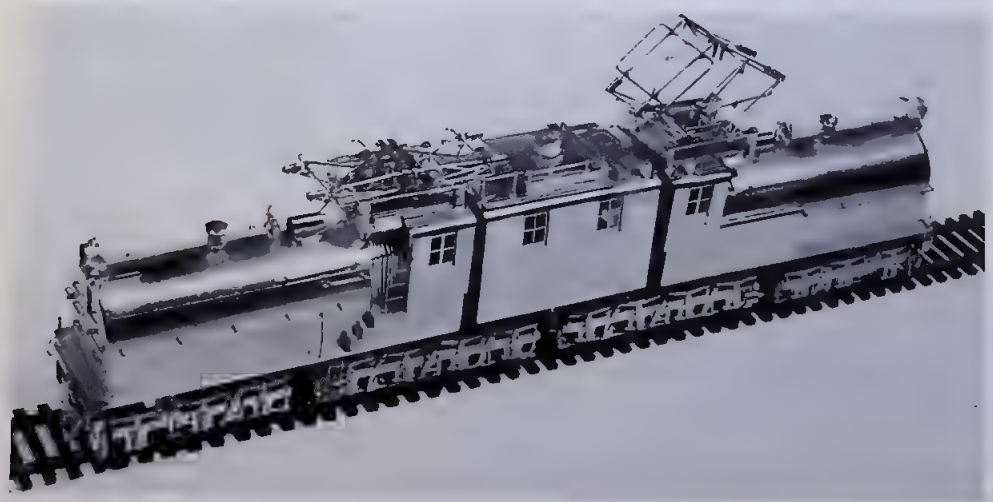
"The Milwaukee, Wisconsin crews didn't know much about electrics," said Wylie. "They did a poor job of rebuilding the Bi-Polars. Thereafter, these motors (the proper term for an

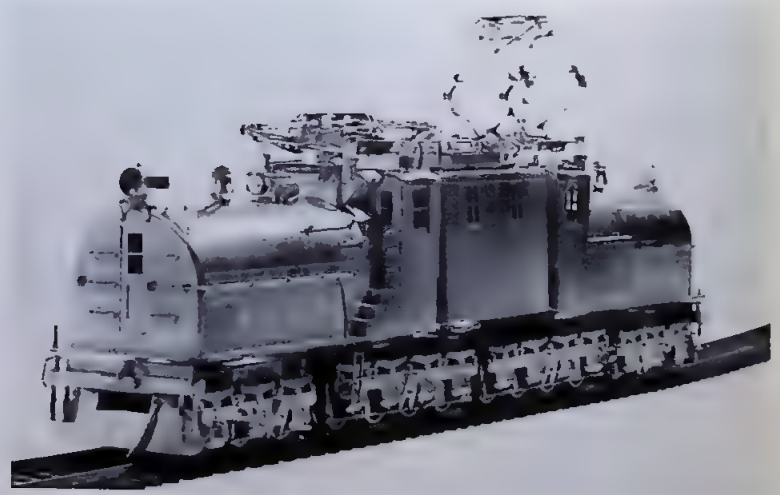
electric locomotive) were plagued by electrical fires, armatures coming apart, etc. We didn't use them much after that."

Barry Kirk, who headed the Electrification Department from 1963 to 1971, was one of Wylie's assistants at the time. He recalls walking through one of the Bi-Polars when it first arrived in Deer Lodge, Montana as a dead headed unit from Milwaukee. "I saw a clump of wires coming out of a cabinet and there was a tag on the wires. It said 'these wires are hot, but we don't know where they go.' "

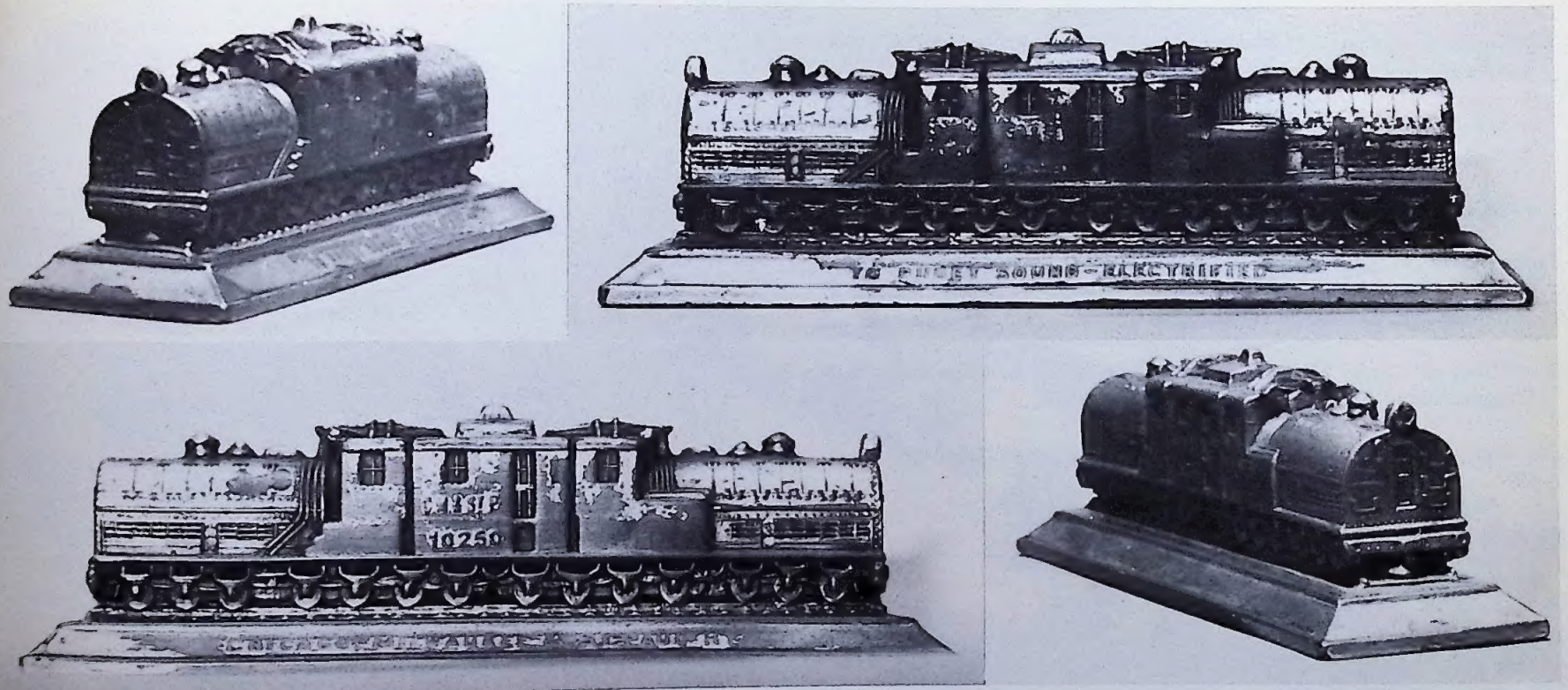
The Bi-Polars returned to service but stayed on the Coast only until mid-1957. The Milwaukee needed more passenger power on the Rocky Mountain Division, and in that year they were transferred.

The Rocky Mountain Division gave them rugged service and this was the Bi-Polars last great challenge; 440 miles of track that crossed three mountain ranges, wide open spaces where speed was really practical, and trains so heavy that double-heading came often. The Bi-Polar had met and matched new challenges before, but this time it was different. They were old





Model photos. At the upper left and right are shots of the HO gauge piece and to the right a comparison of the HO and O gauge replicas./Models and photos by Custom Brass.



The original bi-polar, 10251, was reduced to paperweight size by Arnold Joseph. Although the big bi-polars operated over millions of miles without an accident, the midget model managed to lose a headlight in a table-top collision. The legends on the base of the model read "Chicago Milwaukee Bi-polar" and "To Puget Sound—Electrified."/Photos by William Foreman.

and failure-prone. The Bi-Polars and the crews who ran then struggled to meet the new demands of service. It was rough though, and one aspect of this roughness earned the Bi-Polars some new nicknames. Crews called them Polar Bears, Centipedes, Caterpillars and other names which are unfit for print. The crews who worked from Avery to Harlowton were used to the smooth riding qualities of the Westinghouse Motors and the Little Joes. Though the Bi-Polars were easier on the track than either of those locomotives, they gave their crews a rough ride. To some, it felt like they were going to shake themselves to pieces at speeds over 65. "They rode like lumber wagons," says retired fireman Bill Merrill.

Because of all of the problems the Bi-Polars were experiencing, the Milwaukee pulled them out of service, one by one. This started in 1958 and by 1960, all were in storage. In 1962, E-2 was donated to the St. Louis Museum of Transport. The others were scrapped in Seattle.

Though the Bi-Polars were old and technologically obsolete when retired from service, it still took two E-9 type passenger diesels to provide equal power on a train.

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Andrew Rogerson, retired Milwaukee Road Coast Division engineer. Interviewed 1977.

EDITORIAL ASSISTANCE

Art Jacobsen

Here we have various examples of the ads which appeared over the years attesting to the atributes of the EP-2.

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